TATUNG®

SERVICE INFORMATION

COLOUR DISPLAY MONITOR

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1.0 SAFETY

WARNING:

DANGEROUS VOLTAGE ARE PRESENT IN THIS CIRCUIT WHENEVER POWER IS CONNECTED TO THE CIRCUIT BOARDS.EVEN THOUGH THE PRODUCT POWER SWITCH MAY BE IN THE 'OFF' POSITION . PROPER SAFETY PRECAUTIONS MUST BE TAKEN TO ENSURE THE SAFETY OF PERSONS WORKING ON THE BOARDS.

1.1 SPECIFICATIONS

17 INCH MICRO PROCESSOR CONTROLLED MULTI SYNC COLOR MONITOR

Picture Tube	17 inch(16V) FS, Dark Tinted. Anti-Glare 0.26/0.28 mm dot pitch, INVAR mask 90 degree deflection, Dynamic focus
Resolution	1600X1200/60Hz, Non-Interlaced 1280X1024/76Hz, Non-Interlaced
Display Colors	unlimited
*Display Area	290 mm X 218 mm (typical)
Video Input	Analog-RGB (positive)
Video Bandwidth	130 MHz
Scanning Frequency	Vertical : 50Hz to 120Hz (Auto) Horizontal: 28KHZ to 82KHz(Auto)
Sync. Input Form	Separate Sync. Sync. on green Composite Sync.
Termination	Video inputs: 75 ohm Sync inputs : 470 ohm
Applications	VGA,XGA,8514A,PGC,MACII CAD/CAM,Workstation,etc.
User controls	Micro-processor controls multiscanning Adopt the TWO-DIGIT seven segment display For 25 different Mode Display
Front:	Power Switch, Brightness Control Contrast Control Horizontal Size/Position UP/DOWN Control Vertical Size/Position UP/DOWN Control DPC up/down Control Degaussing Switch Memory Recall Switch
Back:	Sync Switch
Power Input	AC 100-125V/200-240V 47-63Hz (Auto selection)
Power Consumption	130W(max)
Power Saving Mode	5W (110V) 10W (220V) (VESA DPMS Standard.Auto Off/Recovery)
Weight	23KG/28KG(N.W./G.W.)

Dimension(W/O base)	411X380X480 mm (W/H/D)	
Safe Standard	UL/CSA,TUV Optional	
EMI Standard	FCC Class A/B, MPR II FTZ	
Standard Accessory	Tilt/Swivel Base(47 mm height) D-15 pin to Mini D-15 pin signal cable. Power cord	
Recommended Ambience	Operating Temperature:	+0 to +35 degree C (32 to 95 degree F)
	Storage Temperature:	-20 to 60 degree C (-4 to 140 degree F)
	Humidity:	10% to 80 %

* Approximate only. Active display area depends on actual signal timing.

20 INCH MICRO PROCESSOR CONTROLLED MULTI SYNC COLOR MONITOR

Picture Tube	20 inch(19 V), Dark Tinted. Anti-Glare 0.31 mm dot pitch, INVAR mask 90 degree deflection, Dynamic focus
Resolution	1600X1200/60Hz, Non-Interlaced 1280X1024/76Hz, Non-Interlaced
Display Colors	unlimited
*Display Area	350 mm X 262 mm (typical)
Video Input	Analog-RGB (positive)
Video Bandwidth	130 MHz
Scanning Frequency	Vertical : 50Hz to 120Hz (Auto) Horizontal: 28KHZ to 82KHz(Auto)
Sync. Input Form	Separate Sync. Sync. on green Composite Sync.
Termination	Video inputs: 75 ohm Sync inputs : 470 ohm
Applications	VGA,XGA,8514A,PGC.MACII CAD/CAM,Workstation.etc.
User controls	Micro-processor controls multiscanning Adopt the TWO-DIGIT seven segment display For 25 different Mode Display
Front:	Power Switch, Brightness Control Contrast Control Horizontal Size/Position UP/DOWN Control Vertical Size/Position UP/DOWN Control DPC up/down Control Degaussing Switch Memory Recall Switch
Back:	Sync Switch
Power Input	AC 100-125V/200-240V 47-63Hz (Auto selection)
Power Consumption	150W(max.)
Power Saving Mode	5W (110V) 10W (220V) (VESA DPMS Standard.Auto Off/Recovery)
Weight	28.5KG/32.6KG(N.W./G.W.)

Dimension(W/O base)	480X420X540 mm (W/H/D)	
Safe Standard	UL/CSA,TUV Optional	
EMI Standard	FCC Class A/B, MPR II FTZ	
Standard Accessory	Tilt/Swivel Base(47 mm height) D-15 pin to Mini D-15 pin signal cable. Power cord	
Recommended Ambience	Operating Temperature:	+0 to +35 degree C (32 to 95 degree F)
	Storage Temperature:	-20 to 60 degree C (-4 to 140 degree F)
	Humidity:	10% to 80 %

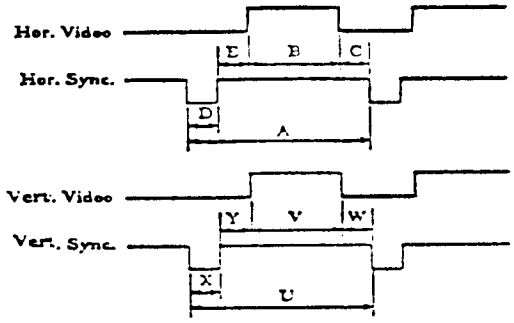
* Approximate only. Active display area depends on actual signal timing.

1.2 Factory Pre-set Signal

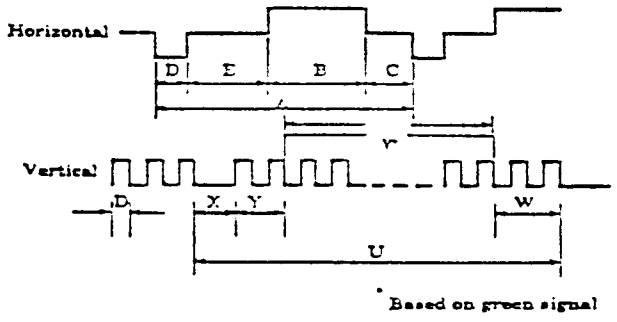
(The mode nc. for factory pre-set is customer dependent)

Mode No.	Signal	Vf Hz	Hf Kz	Sync Polarity Hor.	Vert.	Interlaced
1	640X350	70 Hz	31.5 Kz	+	-	No
2	720X400	70 Hz	31.5 Kz	-	+	No
3	640X480	60 Hz	31.5 Kz	-	-	No
11	1024X768	86 Hz	35.5 Kz	+	+	YES
14	1024X768	60 Hz	48 Kz	+/-	+/-	No
16	1024X768	70 Hz	57 Kz	+/-	+/-	No
22	1024X768	66 Hz	62 Kz	+/-	+/-	No
23	1280X1024	76 Hz	72 Kz	+/-	+/-	No
25	1280X1024	76 Hz	81 Kz	+/-	+/-	No

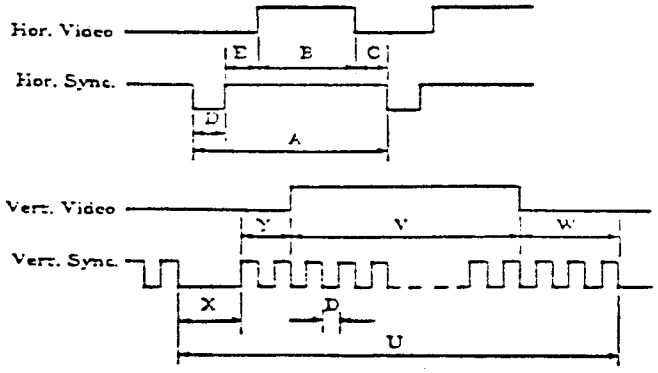
Separate Sync.:



Composite Sync. and Video on Green:



Composite Sync.:



Hor. Parameters
- A – Total Period
- B – Active Video
- C – Front Porch
- D – Sync. Width
- E – Back Porch

Vert. Parameters
- U – Total Period
- V – Active Video
- W – Front Porch
- X – Sync. Width
- Y – Back Porch

1.3 PRE-SET TIMING

Mode	1 640X350 VGA	2 720X400 VGA	3 640X480 VGA	11 1024X768 8514A	14 1024X768 VESA	16 1024X768 VESA
Fh(KHz)	31.5	31.5	31.5	35.52	48.37	56.476
Aus	31.77	31.77	31.77	28.15	20.675	17.707
Bus	25.17	25.17	25.17	22.8	15.95	13.653
Cus	0.94	0.94	0.94	0.18	0.75	0.32
Dus	3.77	3.77	3.77	3.92	1	1.813
Eus	1.89	1.89	1.89	1.25	2.957	1.92
Fv(Hz)	70	70	60	87	60.5	70.069
Ums	14.27	14.27	16.68	11.5	16.52	14.272
Vms	11.126	12.716	15.246	10.81	15.88	13.599
Wms	1.2	0.41	0.35	0.014	0.02	0.053
Xms	0.064	0.064	0.064	0.113	0.08	0.160
Yms	1.88	1.08	1.02	0.563	0.54	0.513
Sync	H/V	H/V	H/V	H/V	H/V	H/V
H POL.	+	-	-	+	+/-	+/-
V POL.	-	+	-	+	+/-	+/-
Interlaced	No	No	No	Yes	No	No

Mode	22 1152X900 WORKSTATION	23 1152X900 WORKSTATION	25 1280X1024 WORKSTATION
Fh(KHz)	61.8	71.71	81.129
Aus	16.18	13.94	12.326
Bus	12.4	10.91	9.481
Cus	0.31	0.15	0.237
Dus	1.38	0.91	0.474
Eus	2.1	1.97	2.133
Fv(Hz)	65.95	76.05	76.106
Ums	15.16	13.15	13.139
Vms	14.56	12.55	12.622
Wms	0.03236	0.02789	0.025
Xms	0.06472	0.11156	0.099
Yms	0.50156	0.46018	0.394
Sync			
H POL.	+/-	+/-	+/-
V POL.	-/-	+/-	+/-
Interlaced	No	No	No

Other timing for reference

Mode	4 640X480 SPARE	5 800X600 VESA	6 800X600 VESA	7 640X480 MACII	8 640X350 XGA	9 640X400 XGA
Fh(KHz)	31.5	35.16	37.879	35	39.4	39.4
Aus	31.77	28.44	26.4	28.57	25.36	25.36
Bus	25.17	22.22	20	21.5	20.8	20.8
Cus	0.94	0.67	1	2.1	0.25	0.25
Dus	3.77	2	3.2	2.1	3.04	3.04
Eus	1.89	3.56	2.2	3.2	1.27	1.27
Fv(Hz)	60	56	60.317	66.67	87.8	87.8
Ums	16.68	17.78	16.579	15	11.3857	11.3877
Vms	15.246	17.07	15.84	13.7	9.18	10.5
Wms	0.35	0.03	0.026	0.086	0.811	0.152
Xms	0.064	0.06	0.106	0.086	0.0507	0.0507
Yms	1.02	0.6	0.607	1.12	1.344	0.685
Sync	H/V	H/V	H/V	Note D	H/V	H/V
H POL.	+/-	+/-	+/-	+/-	+	-
V POL.	+/-	+/-	+/-	+/-	-	+
Interlaced	No	No	No	No	No	No

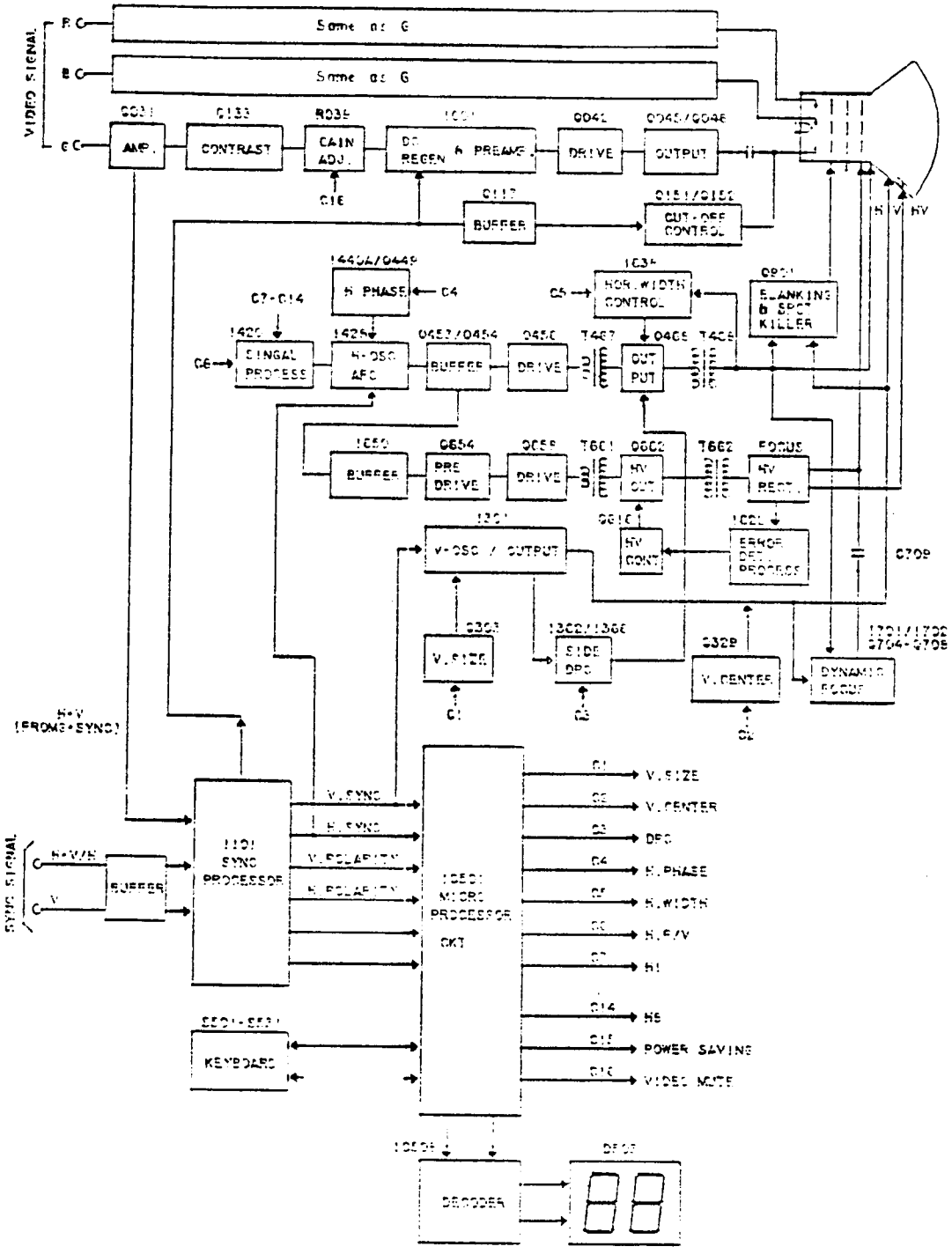
Mode	10 640X480 XGA	12 1024X768 VESA	13 800X600 VESA	15 800X600 VESA	17 1024X768 XGA	18 1024X768 XGA
Fh(KHz)	39.4	45.1121	46.875	48.077	58.14	61.1
Aus	25.36	22.167	21.333	20.8	17.2	16.36
Bus	20.8	15.941	16.162	16	12.8	11.9
Cus	0.25	2.272	0.323	1.120	0.2	0.09
Dus	3.04	0.996	1.616	2.4	3.6	3.72
Eus	1.27	3.1	3.232	1.28	0.6	0.65
Fv(Hz)	75	55.97	75	72.01	72	75.8
Ums	13.3364	17.867	13.333	13.887	13.854	13.222
Vms	12.6	14.5	12.8	12.479	13.2	12.6
Wms	0.0507	0.908	0.021	0.772	0	0
Xms	0.0507	0.089	0.064	0.124	0.138	0.131
Yms	0.635	2.1	0.448	0.479	0.516	0.491
Sync	H/V	H/V	H/V	H/V	H/V	H/V
H POL.	+	-	-	-	+/-	-/-
V POL.	+	-	-	-	+/-	+/-
Interlaced	No	No	No	No	No	No

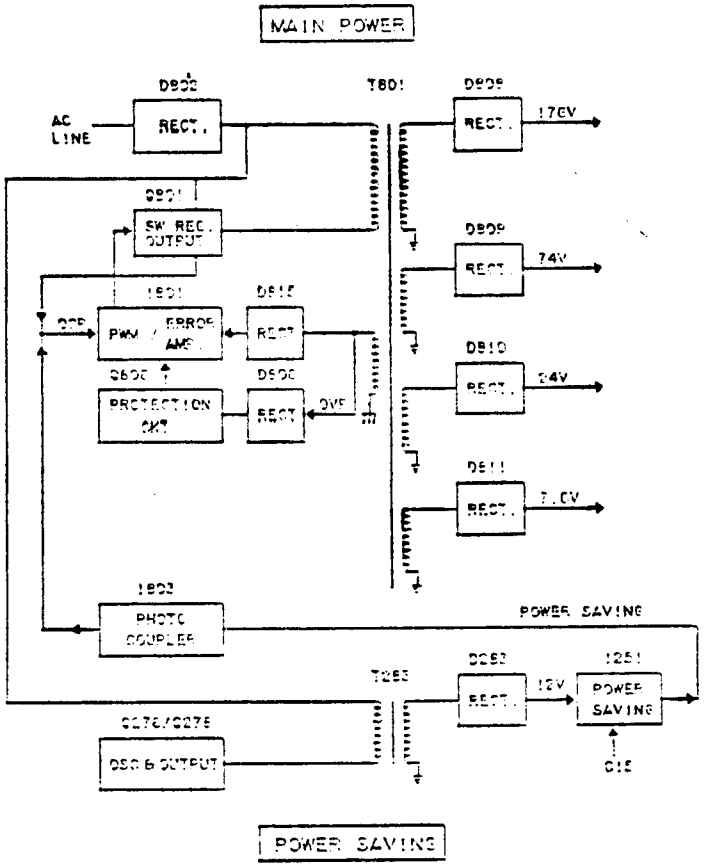
Mode	19 1360X1024 XGA	20 1280X1024 XGA	21 1280X1024 (WORKSTATION)	24 1280X1024	(5) Vf:49Hz TEST	(20) Vf:122Hz TEST
Fh(KHz)	58.11	61	64	74.882	35.156	61
Aus	17.19	16.38	15.62	13.354	28.444	16.38
Bus	12.82	11.96	11.875	10.079	22.222	11.96
Cus	0.15	0.15	0.75	0.252	0.667	0.15
Dus	3.47	3.52	1	1.26	2	3.52
Eus	0.75	0.75	2	1.764	3.556	0.75
Fv(Hz)	105.8	110	60	69.888	49	122
Ums	9.447	9.069	16.67	14.310	20.4081	8.196
Vms	8.82	8.39	16	13.67	19.6971	7.517
Wms	0.06	0.06	0.02	0.027	0.028	0.06
Xms	0.068	0.12	0.08	0.053	0.057	0.12
Yms	0.499	0.499	0.58	0.561	0.626	0.499
Sync	H/V	H/V	Note E	Note E	H/V	H/V
H POL.	+	-	+/-	+/-	+/-	+/-
V POL.	+	+	+/-	+/-	+/-	+/-
Interlaced	Yes	Yes	No	No	No	Yes

NOTE :

A. Mode 1/2/3/11/14/16/22/23/25 are for factory pre-setting.
B. Mode 26/27 are for vertical pull-in range testing only.
C. The other Modes are for reference.
D. For Mac II computer, the sync signal may be Composite or Separate type.
E. For the workstation, the sync signal may be Separate/Composite or G+Sync type.

1.4 FLOW CHART




MAIN POWER
D902
T801
D909
AC LINE
RECT.
RECT.
170V
Q901
SW. REG. OUTPUT
D909
RECT.
24V
1901
D815
PWM / ERROR AMP.
RECT.
Q902
D910
PROTECTION CKT.
D900
RECT.
OVP
RECT.
24V
D911
RECT.
7.0V
1903
PHOTO COUPLER
POWER SAVING
T903
D902
1251
RECT.
12V
POWER SAVING
Q976/Q975
DSG & OUTPUT
D15
POWER SAVING

2.0 ADJUSTMENT

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2.0 ADJUSTMENT PROCEDURE

(1) Standard Adjustment Conditions

A. Power supply voltage: AC 110V/60Hz
B. Warm up time
The display must be on for at least 20 minutes before starting alignments.
This is especially critical in color temperature and white balance adjustments.

C. Instrument: CHROMA-2000 or similar PATTERN GENERATOR
D. Setting:
(G+Sync): Sync Switch "OFF", Power Saving Switch "OFF"
(H/V) : Sync Switch "ON" , Power Saving Switch "OFF / ON"
(H+V) : Sync Switch "ON" , Power Saving Switch "OFF"

Contrast Control	Max
Brightness Control	Max

E. Signals

Video:	Analog 0.7 Vpp/75 ohm Analog sync on green (Video: 0.7Vp-p, Sync : 0.3Vp-p)
Sync :	TTL level NEGATIVE/POSITIVE polarity Separate/Composite (Refer 2.15). (Terminated resistor 470 ohm)
Scanning Freq. :	H 28KHz - 82KHZ V 50HZ - 120Hz

2.1 Pre-Adjustment of POWER SUPPLY (PWB-1786)

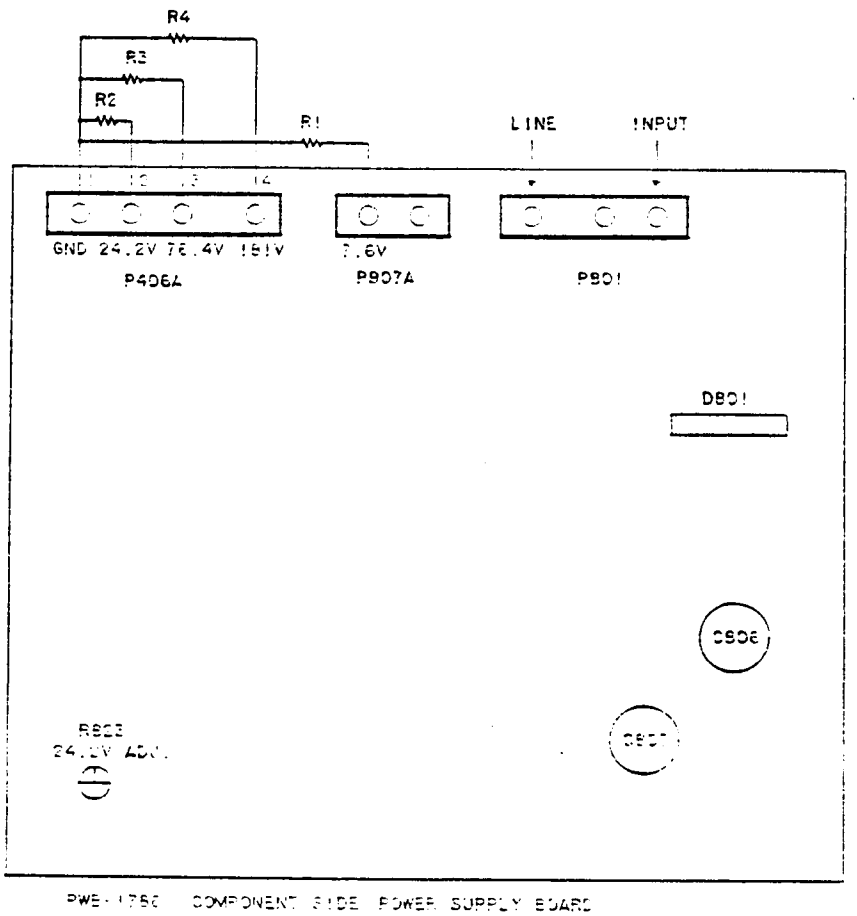
A. Connect the Dummy Load Resistor on P406A with the proper rating values shown below.

Pin			
4	R4	1836	ohm/20W (approx.)
3	R3	500	ohm/12W (approx.)
2	R2	28	ohm/22W (approx.)
1	R1	11	ohm/6W (approx.)

B. Set R823 to minimum position (fully clockwise, viewed from component side).

C. Input 110 VAC line voltage to P801.

D. Adjust R823 (24V ADJ.) so that the voltage on Pin 2 of P406A is 24.2V +/- 0.05V.

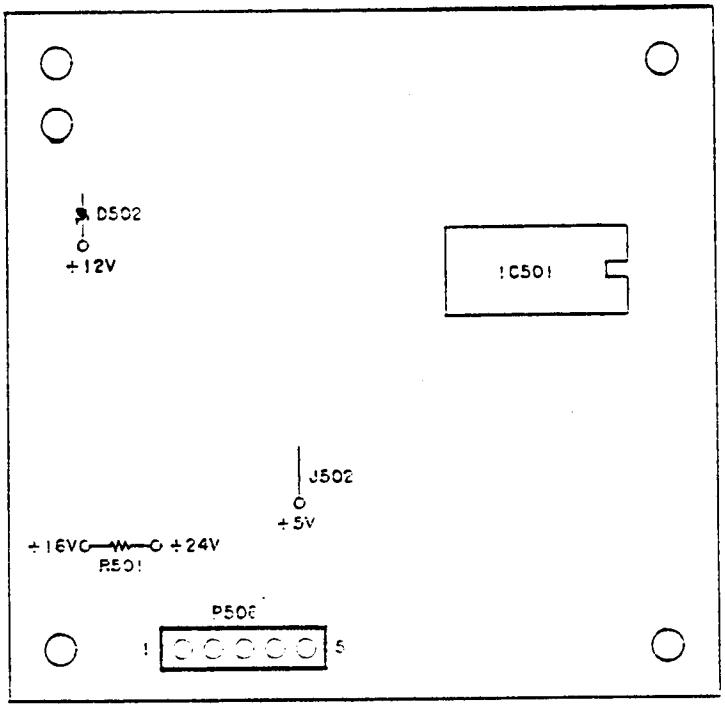


PWB-1786 COMPONENT SIDE POWER SUPPLY BOARD

2.2 Pre-checking of MICRO BOARD (PWB-1796-2)

+16V/+12V/+5V

A. Apply 24V dc voltage to Pin 4 of P506
B. Please check the voltage on the end of D501 and D502 is 16V +/- 1V and 12V +/- 0.5V respectively.
C. Apply 8V dc voltage to Pin 5 of P506
D. Check the voltage on C504 is 5.0V(+/- 0.25V).

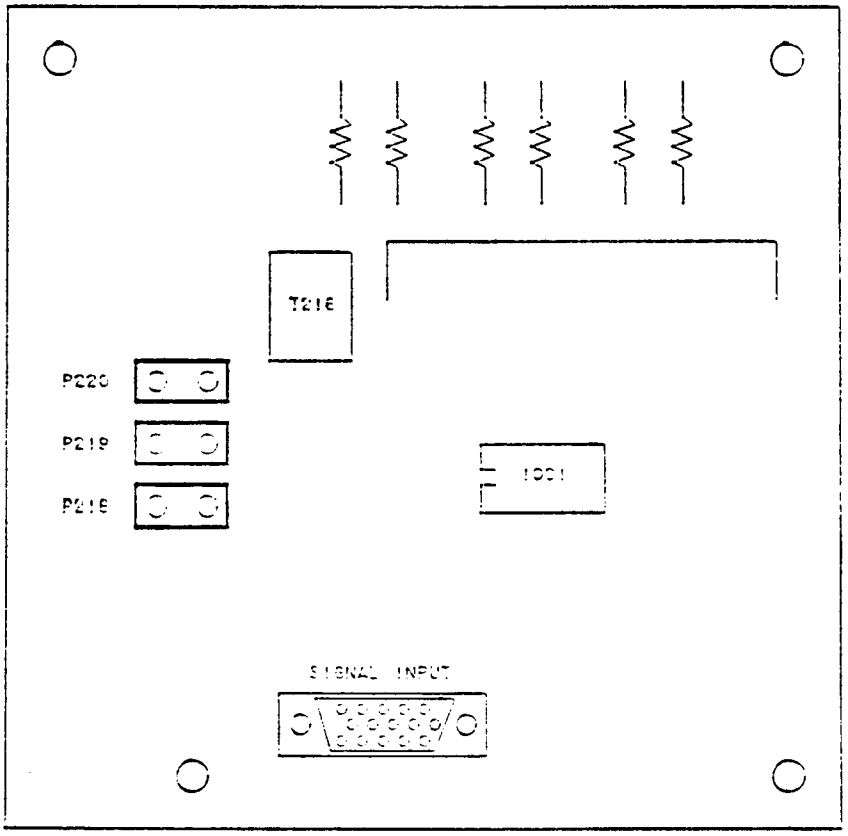


PWB-1796-2 COMPONENT SIDE MICRO CONTROL BOARD

2.3 Pre-Adjustment of MAIN PCB (PWB-1785)

Horizontal Raster Centering

A. Apply signal 25 (81KHz)
B. If necessary, adjust the brightness control so that the raster is faintly illuminated.
C. If necessary, press the width control (S501/S502) so that both edges of the horizontal raster can be seen.
D. Select P218, P219 or P220 on PWB-1796 VIDEO BOARD (either end of the plug), until the raster is centered on the screen. (PWB-1796 VIDEO BOARD)



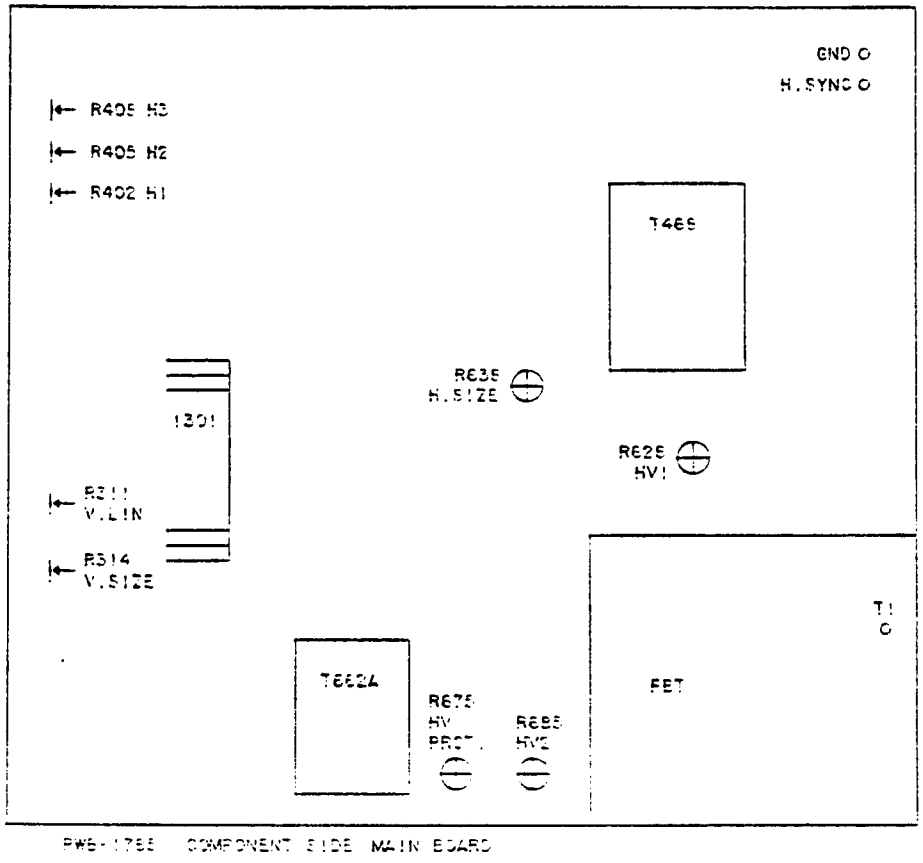
PWB-1796 COMPONENT SIDE VIDEO AMP. BOARD

2.4 MAIN BOARD (PWB-1785) ADJUSTMENT

(1) Horizontal Hold (R408/R405/R402)
 A. Short between T4 and GROUND
 B. Apply signal 25 (81KHz) and adjust H. hold 3 R408 so that the entire picture appears.
 C. Apply signal 18 (61KHz) and adjust H. hold 2 R405 so that the entire picture appears.
 D. Apply signal 26 (28KHz) and adjust H. hold 1 R402 so that the entire picture appears.
 E. Disconnected between T4 and GROUND

 NOTE : ALIGNMENT PROCEDURE

FREQ.	81KHz --->	61KHz --->	28KHz
MODE	No.25	No.18	No.26
ADJ.	R408	R405	R402



PWB-1785 COMPONENT SIDE MAIN BOARD

(2) HV. ADJ.(HV1: R628, HV2: R685)
A. Brightness control and contrast control set at fully clockwise (maximum). Set R685 to minimum (counter clockwise).
B. Set R685 to minimum (fully counterclockwise).
C. Apply signal 25 (81KHz), FULL WHITE pattern
D. Adjust R628 so that the high voltage is 24 +/-0.1KV.
E. Adjust R685 so that the high voltage is 26.5+/-0.2KV. (HV2 is superimposed on the HV1).

(3) HV. Protection (R675)
A. Apply signal 25 (81KHz), FULL WHITE pattern

B. Check the protection function :
Measuring the protection voltage on T1 and ground, adjust R675 slowly to increase the voltage when the voltage reach to 5.57V (Approx.), the high voltage will be shut down, at this moment, please decrease the VR to 45 degree position then power off.
Please power on again, the high voltage will back to normal.

C. Adjust R675 so that protection voltage on T1 is 5.5V-5.55V.

(5) Horizontal Width pre-setting (R638)
A. Apply signal 25 (81KHz)
B. Adjust H. SIZE control S501 to get maximum width on the screen.
Adjust R638 so that the voltage on B+(DEF.) is Va (see table).

D. Adjust H.SIZE control S502 to get minimum width on the screen.
Check the voltage on B+ (DEF.) is Vb (see table).
Check the collector voltage of Q455 is 17.8V(+/- 0.3V).

E. Apply signal 1 (31KHz)
Adjust H.SIZE control S501 to get maximum width on the screen.
Check the collector voltage of Q455 is 23.6V(+/- 0.6V).

	17" HITACHI M41KVZ180X12	17" MITSUBISHI AF17G9S_B22	20" HITACHI M48KMZ180X11
Va	107V+/-0.3V	115V+/-0.3V	110V+/-0.3V
Vb	93V+/- 3V	99V+/- 3V	

* With the different CRT or YOKE the voltage of Va/Vb should set at the correct value. If it is not correct setting, it may damage the output circuit or lack of the enough width.

(6) Vertical size pre-set (R314)
A. Apply signal 11 (15KHz), crosshatch pattern
B. Adjust V. SIZE control S505 to reach the size on step " 50 ". The step number is indicated on the seven segment display which is mounted on the control panel.

C. Adjust V.SIZE pre-set R314 so the vertical height is reach to the following values.

17"	20"
235(+/- 7)mm	278(+/- 3)mm

(7) Vertical Linearity (R311)

A. Apply signal 25 (81KHz), crosshatch pattern
B. Adjust size control S505/S506 so that the vertical size is approximately (17" : 218mm, 20" : 262mm).
C. Adjust R311 so that vertical linearity is optimum.

(8) Vertical Pull-In range checking

A. Apply signal 26 (49Hz) and signal 27 (122Hz), please check the picture is normally displayed no matter power on/off again.

(9) Sync type checking

A. Apply composite type sync signal, the picture should be normally displayed.

B. Apply G+sync type (signal 18) sync signal, the picture should be normally displayed.

2.5 Factory pre-setting for screen Position/Size/Side Pin Cushion.

HOW TO PROCEED THE FACTORY PRE-SETTING ?

A. PUSHING THE HOR. FREQ. SW. AND POWER ON FOR 2 SECONDS THEN RELEASE THE PUSHING.
(The HOR. FREQ. SWITCH is inside the control cover).

B. During the setting (change MODE) or leave setting for 4 seconds the data will be saved into the memory automatically.

C. After 4 seconds later, switch off the power and power on again, the data stored inside the memory will be the factory setting data.

D. The data could be retrieved by pushing the MEMORY RECALL SW. (First hole of the right side)

E. If more than one signal requires readjustment, please repeat steps (A) through (C).

* For signal 1 to 25, check that the screen position and size fall within the following limits.

(1) Screen Size

	17"	20"
Horizontal	290(+/- 5)mm	350(+/- 5)mm
Vertical	218(+/- 5)mm	262(+/- 5)mm
Screen Position	Space between bezel picture Top and bottom space difference: +/-5mm Right and left space difference: +/-5mm	

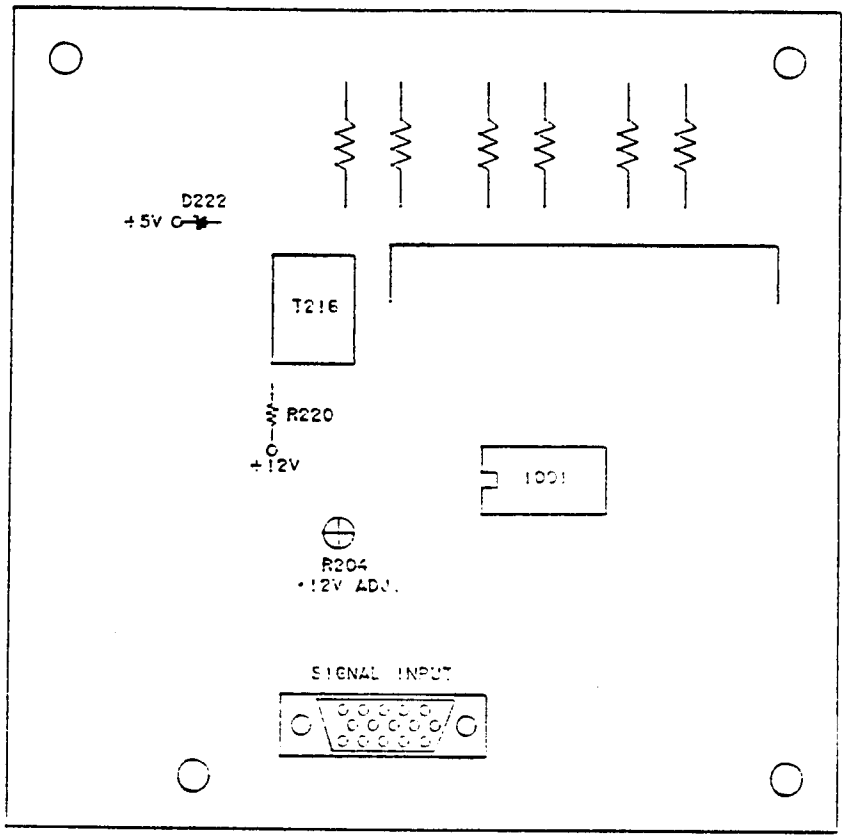
(2) Side Pin Cushion

A. Apply crosshatch pattern
B. Check to if the side pin cushion distortion is within +1,-2 mm

2.6 Video Amplitude Adjustment

+12V (R204) Pre-adjustment

A. Apply signal 25 (81KHz), full white pattern
B. Adjust R204 so that the voltage on +12V test Pin (or R220) is 12V +/- 0.1V.
C. Check the voltage on D222 is 5V +/- 0.3V.



PWB-1790 COMPONENT SIDE VIDEO AMP. BOARD

Video Amplitude Adjustment

* Check to make sure the video input signal is set at the following level.

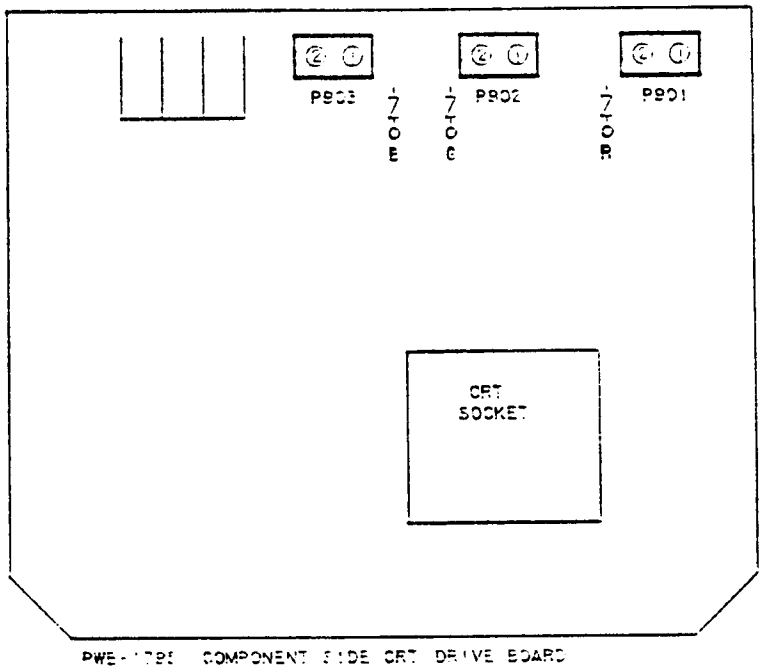
A. Video: Analog 0.7Vp-p (75 ohm), not include the sync signal
B. Sync Switch: ON
C. Signal: 25 (81KHz), crosshatch
D. Initial Settings of Adjustment VRs

R564:	Contrast VR	fully clockwise
R561:	Brightness VR	fully counterclockwise
R009,R039,R069:	GAIN VR	Mid'POINT
SCREEN VR		Mid'POINT

2.7 Gain adjustment

A. Adjust R009(R)/R039(G)/R069(B) so that the terminals(Pins 2 of P901/P902/P903) on the CRT PWB are each set to 47Vp-p not including the blanking pulse.)

* Please use the plastic adjusting pole to do the alignment.



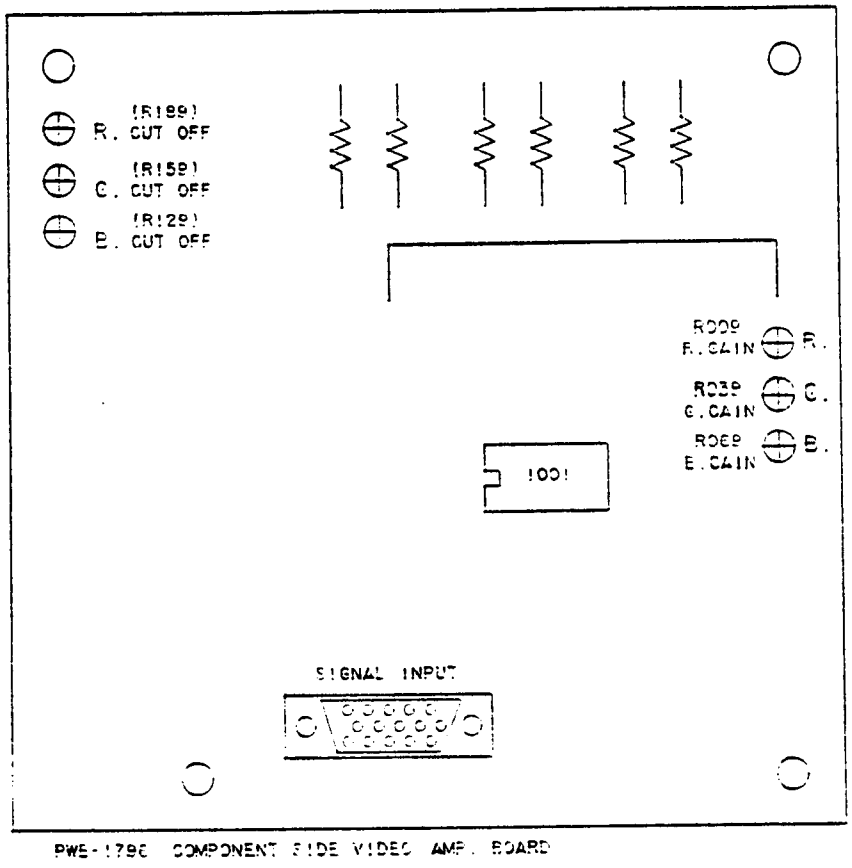
2.8 Cut-off adjustment

A. Initial setting of the adjustment VRs

R189,R159,R129:	CUTOFF VR	Mid'POINT
R561:	Brightness VR	fully clockwise
SCREEN VR:		fully counterclockwise

B. Apply signal 25 (81KHz), crosshatch pattern
C. Adjust G1 control VR907(PWB-1795) so that the voltage on G1 is Vc (See Table).

	17" HITACHI M41KVZ180X12	17" MITSUBISHI AF17G9SLB22	20" HITACHI M48KMZ180X11
Vc	-60V	-80V	-70V



PWB-1796 COMPONENT SIDE VIDEO AMP. BOARD

D. As SCREEN VR is gradually turned clockwise, a signal color will appear. Turn the CUTOFF 1 VR counterclockwise for this color.

E. Again, turn SCREEN VR clockwise gradually, a signal color will appear again. This color is the reference color for the cut off adjustment. Set the background color faintly appears then adjust the other two CUTOFF VRs (other than the reference color) to form a white background.

NOTE:

* White tracking will be best at dark cut off adjustment settings. For the best setting, therefore, perform the cut off adjustment in as dark a place as possible.

2.9 Cut off Fine Adjustment

A. Apply pattern 70, background only.

B. Initial Settings of Adjustment VRs

R564:	Contrast VR	fully counterclockwise
R561:	Brightness VR	fully clockwise

C. Adjust Screen VR to get the background brightness is : 1 FL +/- 0.2 FL.
Adjust R Cut off VR(R189) and B Cut off VR(R129).

D. Measure the color temperature X and Y
X=281 (+/- 5) , Y=311 (+/- 5)

2.10 Contrast Tracking

A. Adjust G GAIN VR(R009) and B GAIN VR(R069).
Measure the color temperature X and Y

B. Check the color temperature X and Y between the following condition:
(1) Brightness MID, Contrast MAX
(2) Brightness MID. Contrast >3FL

X=281 (+/- 5) , Y=311 (+/- 5)

C. Apply pattern 57
Check the brightness under the following condition:
(1) Brightness MID, Contrast MAX

The brightness should be between 40FL - 55FL
If over 55FL, please readjust R GAIN/G GAIN/B GAIN VR.

2.11 Background Luminance Adjustment

A. Initial setting of the adjustment VRs

R561:	Brightness VR	MID POINT
R564:	Contrast VR	MIN

B. Apply signal 25 (31KHz), crosshatch pattern

C. Adjust SCREEN VR so that the background faintly appears.

2.12 Focus Adjustment

(1) Double Focus (MITSUBISHI/HITACHI Tube)

A. Apply signal 25 (81KHz), crosshatch pattern

Initial checking
When using the HITACHI or MITSUBISHI tube, please check the parabola amplitude is under the following condition.

HITACHI 17" tube (M41KVZ180X12)
Horizontal : > 250 Vpp
Vertical : > 100 Vpp

MITSUBISHI 17" tube (AF17G9SLB22-E-TC28)
Horizontal : > 200 Vpp
Vertical : > 85 Vpp

HITACHI 20" tube (M48KMZ180X11)
Horizontal : > 250 Vpp
Vertical : > 100 Vpp

B. Initial setting of the adjustment VRs

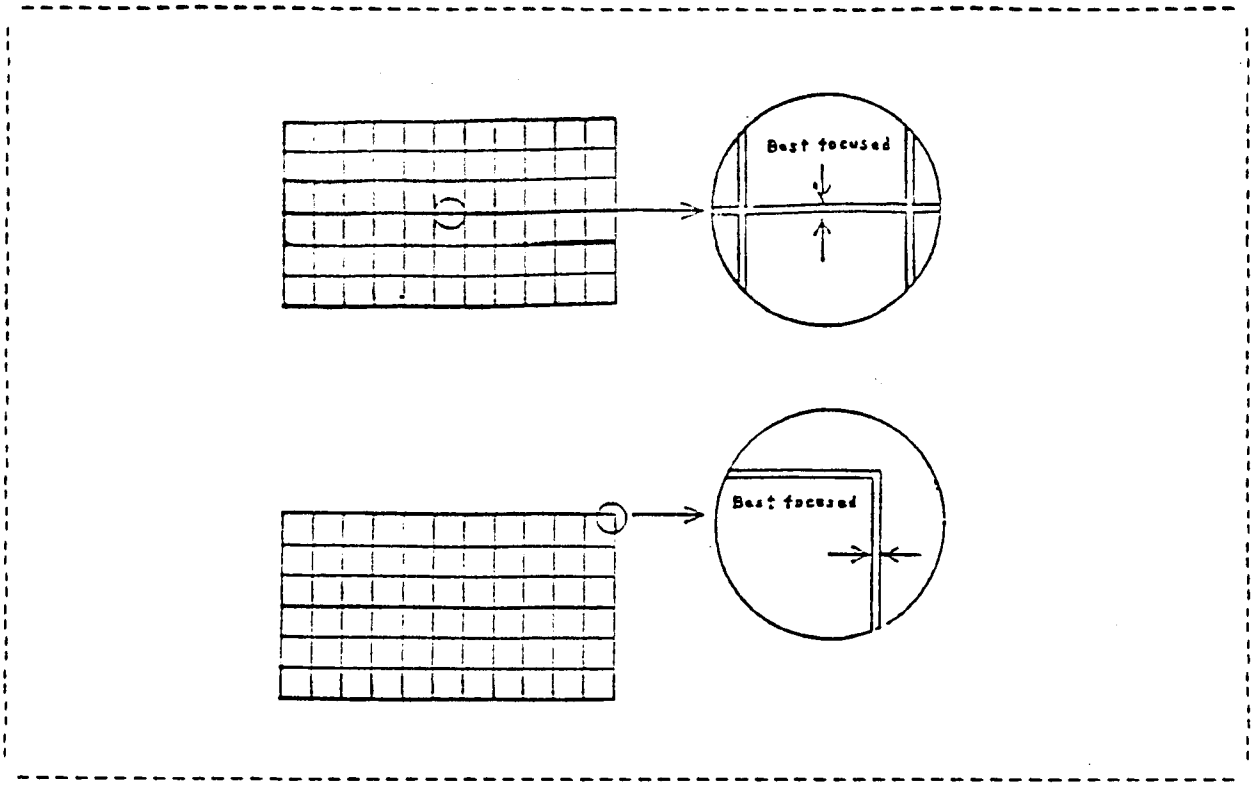
R561:	Brightness VR	MID'POINT
R564:	Contrast VR	MAX

C. Or receive the pattern with "e" character

D. Focus 1:
Should be adjusted so that the vertical lines become narrowest in all over the screen.

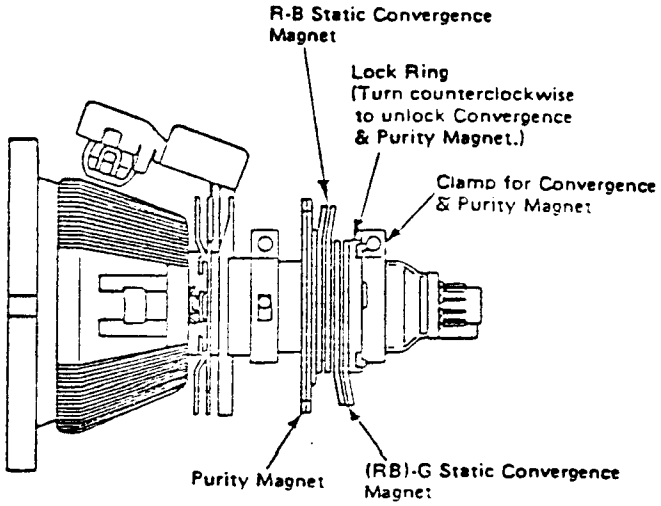
E. Focus 2:
Should be adjusted so that the horizontal lines become narrowest in all over the screen.

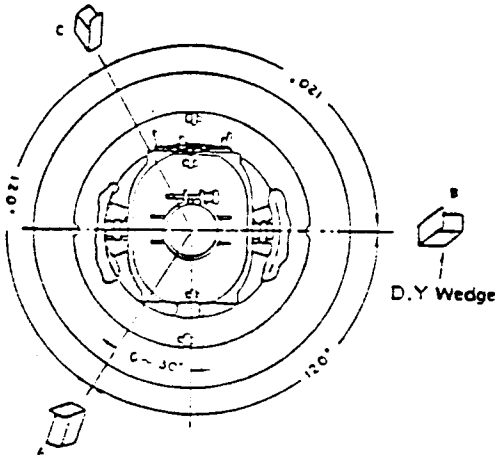
F. Repeat the adjustment procedure in step D & E until the vertical and horizontal lines are all clear at center and corner of screen.


Best focused
Best focused

2.13 Purity Adjustment

A. Be sure the display is not being exposed to any external magnetic fields.
B. Ensure that the spacing between the Purity Convergence Magnet (PCM) assembly and the CRT stem is 29mm (+/- 1mm).
C. Produce a complete red pattern on the screen.
D. Adjust the purity magnet rings on the PCM assembly to obtain a complete field of the color red. This is done by moving the two tabs in such a manner that they advance in an opposite direction but at the same time to obtain the same angle between the two tabs, which should be approximately 180 degrees.
F. Check the complete blue and complete green patterns to observe their respective color purity. Repeat steps A to D if needed.

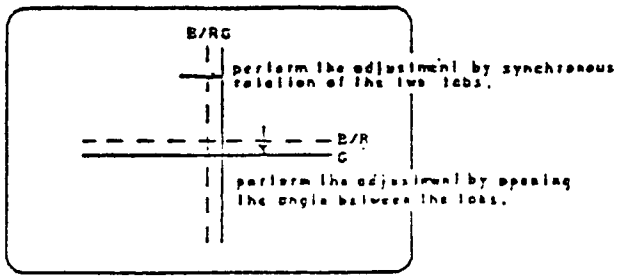

R-B Static Convergence Magnet
Lock Ring
(Turn counterclockwise to unlock Convergence & Purity Magnet.)
Clamp for Convergence & Purity Magnet
Purity Magnet
(RB)-G Static Convergence Magnet



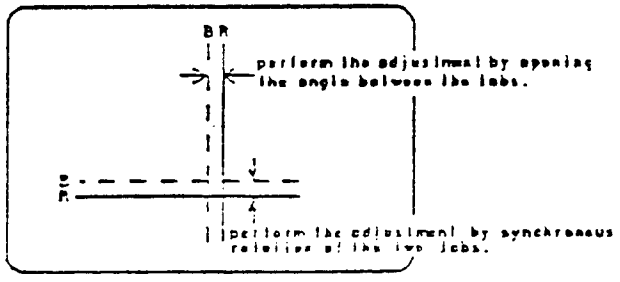
2.14 Convergence Adjustment

* Before adjustment convergence,the vertical size, linearity and focus adjustment must completed.
* Make sure the Purity is good before the following adjustment.

A. Apply signal 25 (81KHz),crosshatch pattern (pattern 7).
B. The brightness level should be no higher than necessary to obtain a clear pattern.
C. Loosen the convergence magnet lock ring, converge the RED and BLUE lines at the center of the screen by rotating the R-B static Convergence Magnet.
D. Align the converged RED/BLUE lines with the GREEN lines at the center of the screen by rotating the (R/B)-G Static Convergence Magnet.
E. Tighten the convergence magnet lock ring.
F. Remove the IY wedges and slightly tilt(do not rotate) the deflection yoke horizontally and vertically to obtain good overall convergence.
G. Secure the deflection yoke by re-inserting the wedges.
H. Check convergence and Purity. If purity error is found. Please repeat the purity adjustment.



Green to Magenta Convergence
(White)



Red to Blue Convergence
(Magenta)

2.15 Factory Pre-set Signal

Mode No.	Signal	Vf Hz	Hf Kz	Sync Polarity Hor.	Vert.	Interlaced
1	640X350	70 Hz	31.5 Kz	+	-	No
2	720X400	70 Hz	31.5 Kz	-	+	No
3	640X480	60 Hz	31.5 Kz	-	-	No
11	1024X768	86 Hz	35.5 Kz	+	+	YES
14	1024X768	60 Hz	48 Kz	+/-	+/-	No
16	1024X768	70 Hz	57 Kz	+/-	+/-	No
22	1024X768	66 Hz	62 Kz	+/-	+/-	No
23	1280X1024	76 Hz	72 Kz	+/-	+/-	No
25	1280X1024	76 Hz	81 Kz	+/-	+/-	No

2.16 Set the user switch before packing

A.	CONTRAST VR	Fully clockwise(MAX)
B.	BRIGHTNESS VR	MID'POINT
C.	SYNC SW.	ON
D.	POWER SAVING SWITCH	ON or OFF (Customer requirement)

3.0 CIRCUIT DESCRIPTION

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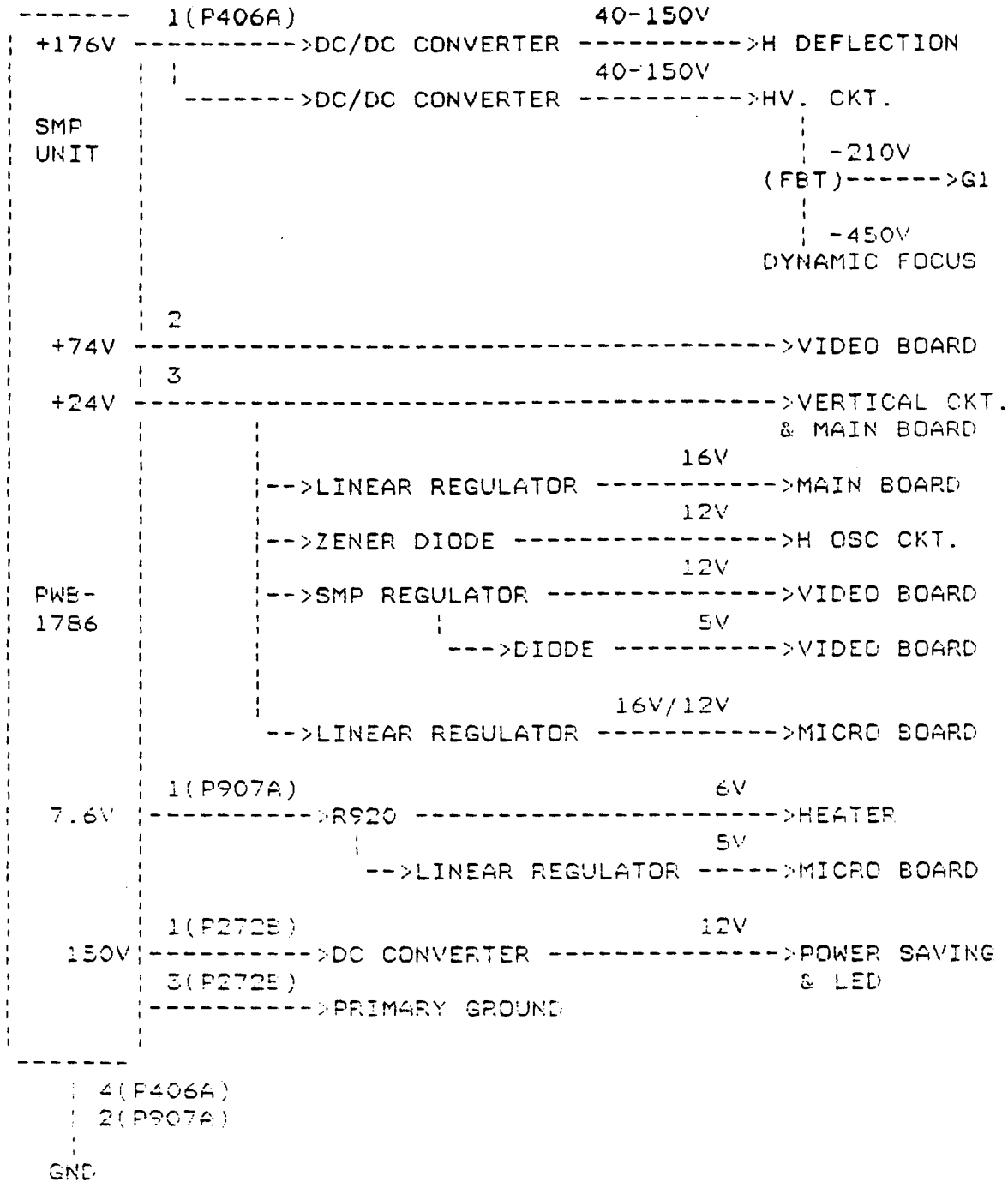
3.0 CIRCUIT DESCRIPTION

3.1 SWITCHING MODE POWER SUPPLY (SMPS) (PWB-1786)



(The power of the LED is fed from P731A of the power saving board PWB-1819. Please Refer to circuit diagram Fig-6)

Analog circuit supply lines of 176V/74V/24V are supplied by the secondary winding of T801 (Pins 1/2/3 of P406A respectively).

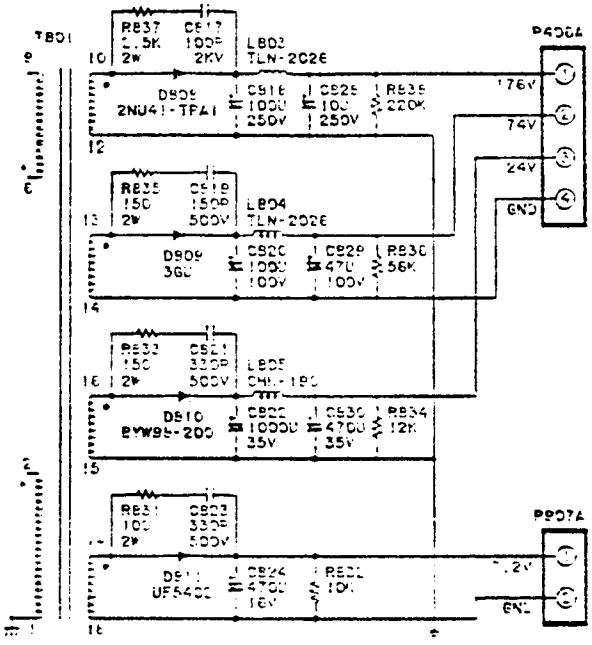
Analog circuit supply lines of 7.2V is supplied by the secondary winding of T801 (Pins 1 of P907A).

The power saving supply lines of 150V is supplied by the primary dc voltage via Pins 1 & 3 of P272B.

(Refer to circuit diagram Fig-1)

(Main Power)	176V /0.35A	(approximately)
"	74V /0.3A	"
"	24V /0.75A	"
"	7.2V /0.32A	"
(Power Saving)	12V /0.05A	"

SMPS SECONDARY CIRCUIT Fig-1



3.2 PRIMARY CIRCUIT

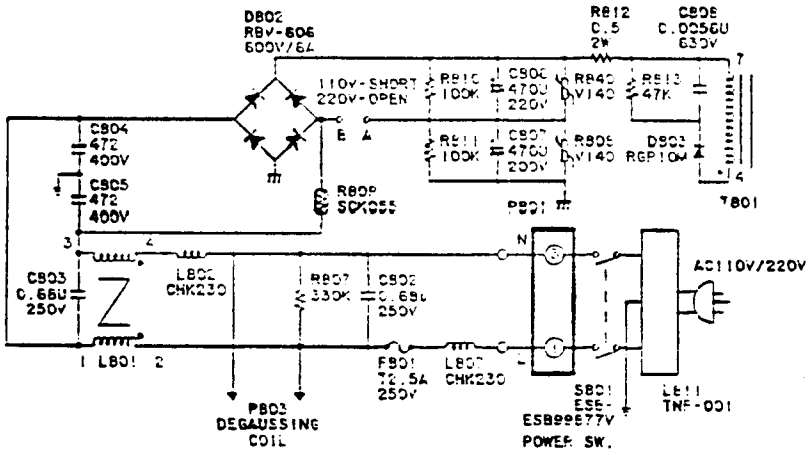
(Refer to circuit diagram Fig-2)

Mains electricity is filtered by line choke L801 and rectified by bridge D802. The rectified high tension (HT.) line is smoothed by storage capacitor C806/C807.
Suppressors R840, R808 are designed to protect the circuit from the effects of destructive voltage transients or from abnormal of AUTO DOUBLER circuit.

When subjected to high energy transient currents, their impedance rapidly changes from a high standby value to a low conducting value to keep voltages within safe limits or to protect the circuit by blowing the fuse.

S801 is the power switch of the line input.

SMPS PRIMARY CIRCUIT Fig-2



3.3 AUTO DOUBLER

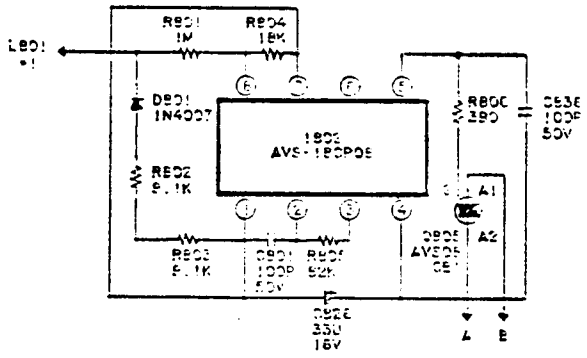
(Refer to circuit diagram Fig-3)

The monitor is design to use in the different line areas. There is a AUTO DOUBLER which is connected between Pins A & B to maintain a suitable working voltage for the primary switching transistor Q801.
The control signal (on Pin 5) is made by the comparison of the mains voltage (on Pin 8) with internal threshold voltages.

For line input between 100V and 125V, Triac Q805 is triggered by Pin 5 of I802, A1 and A2 is short, the auto doubler is activated. Pins A & B is short.
For line input between 200V and 240V, Triac Q805 is off, A1 and A2 is open, Pins A and B is open.

The oscillation frequency is determined by the mains frequency (50 Hz or 60 Hz) and R805/C801, the control frequency is made on Pin 3.

AUTO DOUBLER CIRCUIT Fig-3



3.4 CURRENT MODE CONTROLLER

(Refer to circuit diagram Fig-4)

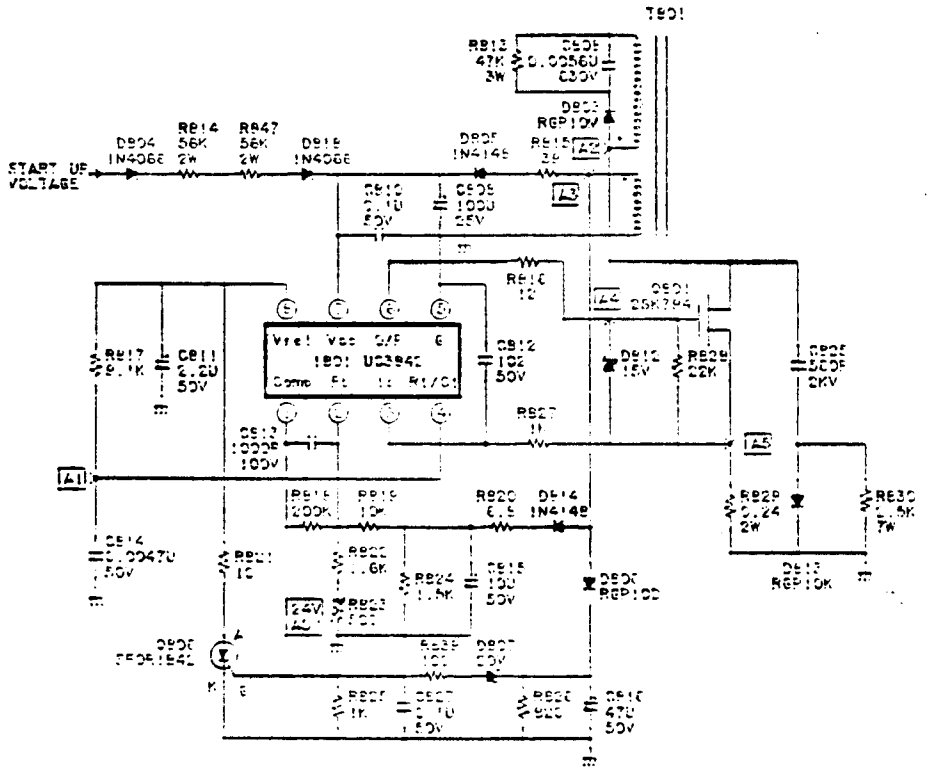
Current Mode PWM controller module I801 (UC3842) is used to drive the SMPS switching MOSFETs Q801. The drive signal is inhibited if the current sense line (Pin 3) rises above 1V.

START UP CIRCUIT

The start up voltage on Pin 7 of I801 is provided from C809 which charges through R814/R847 (connected to the HOT LINE) on power on. The start up line is about 20V during normal operation.

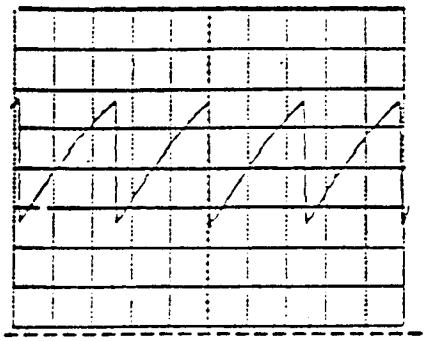
After start up, the normal operation voltage is provided from Pin 2 of T801 via D805 and R815, R815 reduces the supply voltage to I801 within the manufacturers specification.

SMPS DRIVE Fig-4

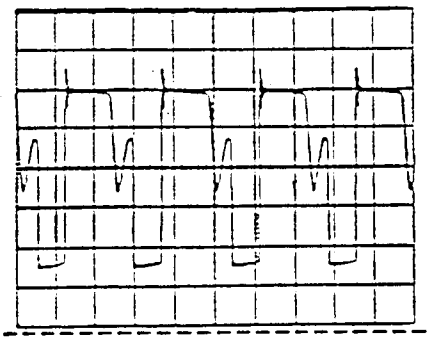


TEST CONDITION	TEST POINT	TEST POINT NAME
Fh=31KHz	A1	OSC VOLTAGE
	A2	DRAIN VOLTAGE
	A3	AUXILIARY WINDING PULSE
	A4	GATE VOLTAGE
	A5	SOURCE VOLTAGE

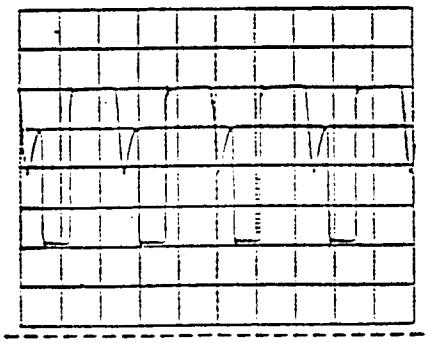
A1 1.5 Vpp



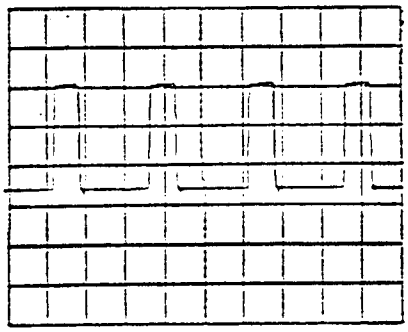
A2 450 Vpp



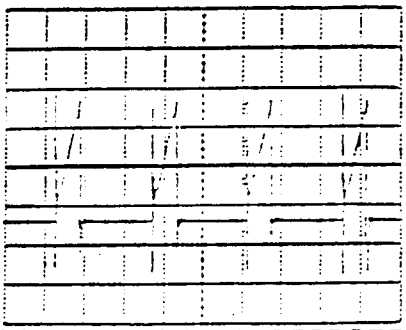
A3 40 Vpp



A4 15 Vpp



A5 0.9 Vpp



PULSE WIDTH CONTROL CIRCUIT

The supply outputs are regulated by monitoring the voltage on the auxiliary winding (Pins 1 and 2) of T801 which is well-coupled and in phase with primary winding.

The feedback voltage is connected to pin 2 of I801 through divider R820-R818-R819 with R818 enabling fine adjustment of the output voltage.

Pin 2 of I801 is the inverting input of the Error Amplifier. The error amplifier compares the voltage (Pin 2) with the internal reference voltage (2.5V) then generates an error voltage to next stage (comparator).

The sawtooth voltage on source resistor R828 is proportional to inductor current and is connected to pin 3 via D148 and R820.

The internal comparator compare the error voltage with the sawtooth voltage of pin 3, then generate a modulated PWM signal for the output stage Q801.

C813/R818/R822/R823 (on Pins 1 & 2) optimize the stability of the control system by defining the loop gain of the Error Amplifier.

D812 holds the base of Q801 at 15V during normal operation.

Snubber C825/R830/D813 compensates for leakage inductance in T801 and shapes the base drive waveform so that the initial turn on current is high.

SAWTOOTH OSCILLATOR CIRCUIT

The oscillation frequency and maximum output duty cycle are programmed by connecting resistor R817 to Vref (Pin 8) and capacitor C814 (on Pin 4) to ground. The oscillation frequency is around 40KHz.

PROTECTION CIRCUIT

The power supply has a full protection circuit against output overload ,short circuit and over voltage.

OVER CURRENT PROTECTION CIRCUIT

Once the over load or short circuit occurred at the secondary.the voltage of R829 reach to 1 Vp-p rapidly. It blocks the power output. Q801 turns off, then the power circuit will shut down.

POWER SAVING CONTROL SIGNAL

When at the power saving mode, a "SHUT DOWN" instruction is sent from the micro control pcb, the Power Saving control signal is fed to Pins 1 & 2 of the photo coupler I803 via Pin 1 of P506A and is coupled to the internal transistor (Pins 5 & 4) via the emitting light of the internal diode.

Pin 5 of I803 is connected to Vref (Pin 8 of I801), the dc voltage will shut down the output (Pin 6) of I801 via Pin 4 of I803.

OVER VOLTAGE PROTECTION CIRCUIT

On abnormal conditions,if the over voltage presents at auxiliary winding (Pins 1 & 2 of T801), Q806 will be triggered by the voltage Via D807/R839/R825 and C827. The voltage on pin 8 is latched and grounded to 0V, then I801 turns off,the power circuit will shut down.

If the output housing is disconnected, the voltage on Pins 1 & 2 goes up, the output voltage will shut down.

For the single power supply PCB test only,a dummy load should be connected to P406A & P907A. (see alignment.)

3.5 DEGAUSSING CIRCUIT

(Refer to circuit diagram Fig-5)

AUTOMATIC DEGAUSSING CIRCUIT

Network SR801/Q802/Q803/Q804/degaussing coil and relatives parts compose an automatic degaussing circuit to demagnetic the shadow mask and internal shield in the CRT.

When power is on, Q802 is on,relay SR801 is activated, Pins 1 & 2 of SR801 is contacted, the degaussing current is flew into the degaussing coil via R846.

Posistor R846 shows low resistance value (5 ohms) in normal temperature, when apply AC line voltage, a big current flows into degaussing coil. a few seconds. the resistance of posistor increase rapidly due to rising in heat, degaussing current thus decrease to less than 100 mA rapidly, degaussing function is completed.

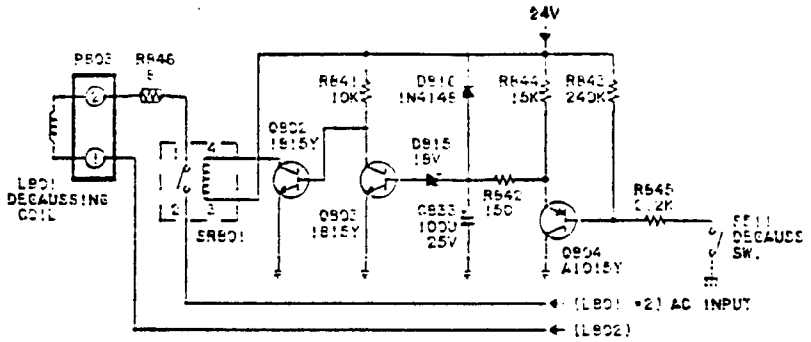
Network R844/R842/C803 define the process time of auto degaussing (it is about three seconds). Once the capacitor C803 is charged. the voltage is fed to the base of Q803 via D815, Q802 will turn

off by Q803, the contact (Pins 1 & 2) of the relay is open, at this moment, no current is flew into the degaussing coil.
The degaussing coil has a resistance of 5 ohms (approx.).

MANUAL DEGAUSSING CIRCUIT

Switch S511 and Q804 are used as a manual degaussing circuit, when S511 is pressed, the voltage which is originally charged on C833 , will be discharged by Q804, Q803 is off and Q802 is on, the auto degaussing action will start again.

DEGAUSSING CIRCUIT Fig-5



3.6 POWER SAVING CIRCUIT (PWB-1819)

(Refer to circuit diagram Fig-6)

The working voltage (+12V) of the power saving circuit is provided by a RCC switching power supply (Q276/Q277/C278/T283).

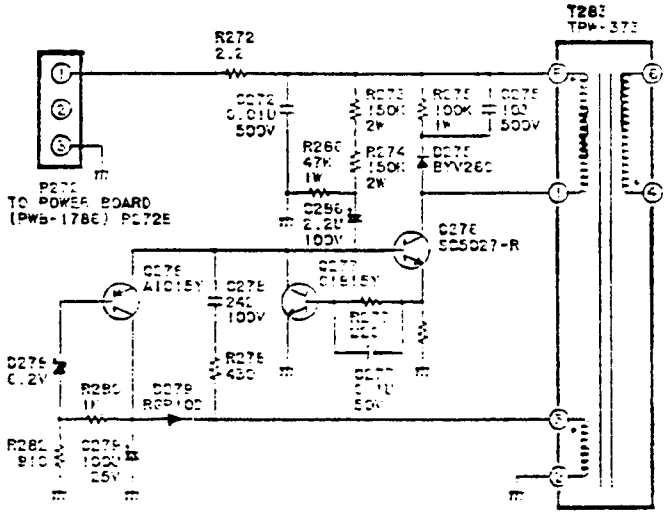
A dc voltage (230V to 300V) is fed to Pin F of the transformer T283 via Pin 1 of P272. The switching transistor Q276 is triggered to the saturate state (ON) by start up circuit R273/R274/R286/C286, a auxiliary voltage is generated from Pin 3 and fed to the base of Q276 via R278/C278.

When the current of Q276 decreased, the auxiliary voltage is decreased as well. Finally, this will force Q276 reach to OFF state. At this moment, the energy which is stored in the winding (Pins F & 1) at saturate state, is passed to the secondary Pin 6, the output voltage (+12V) is taken via D283 & C283.

Once, all the energy is passed, Q276 will be triggered to ON again, the ON/OFF operation is going on.
The output voltage or operating frequency is auto controlled by the conduction of Q278 via rectifier D279 and capacitor C279 and D278/R280/R282.

The over current protection circuit is composed of Q277/R277 and C277. When the secondary output is short or over loading, the voltage drop on R276 is increased, the OVP circuit (Q277) will shut down the switching transistor Q276 to protect the components.

+12V FOR POWER SAVING CIRCUIT Fig-6



The DPMS (Display Power Management Signal)

The DPMS control signal is derived from micro control board PWB-1796-2. At the state 3 & 4, the sync signal is missing, the main power (PWB-1786) will shut down by the DPMS control signal and will auto recover when the sync signal appear again.

Power Management

There are four POWER steps for the Power Management.

1. Normal State :Both H Sync and V Sync are present.

   -Light of LED Green.
   -100 % of power consumption.

2. Stand-by State :Inactive of H Sync, video to be blanked.

   -Light of LED Green.
   -80 % of power consumption.
   -Respond Time Approx. 2 sec.
   -Recovery to Normal State Receiving the H Sync.
   -Recovery Time Approx. 2 sec.

3. Suspend State :Inactive of V Sync, video to be blanked.

   -Light of LED Amber.
   -5 W of power consumption.
   -Response Time Approx. 5 sec.
   -Recovery to Normal State Receiving the V Sync.
   -Recovery Time Less than 15 sec.

4. Off State :Inactive of H & V Sync, video to be blanked.

   -Light of LED Amber.
   -5 W of power consumption.
   -Response Time Approx. 5 sec.
   -Recovery to Normal State Receiving the normal Sync.
   -Recovery Time Less than 15 sec.

3.7 AUTO OFF (Power Saving Mode)

(Refer to circuit diagram Fig-7)

The 'auto off' control signal (high level) is fed to Pin 3 (non-inverting pin) of the comparator I267a via buffer Q257, the reference voltage on Pin 2 is fixed at 3.2V by D251. the high level output (Pin 1) of I267a is fed to Pin 1 of P506 via Q255/R262 to shut down the main power. At this mode, the amber color led is lit via Pin 3 of P7314. D732 and C285 are static voltage discharge protection components.

R260 is the latch resistor which is connected between Pins 1 & 3, it used to keep the I267a at currently state when the input signal is not existing.

The clear signal is fed to Pin 5 of I251 via R258, it is to clear the output of I251 every time when power saving is functioned.

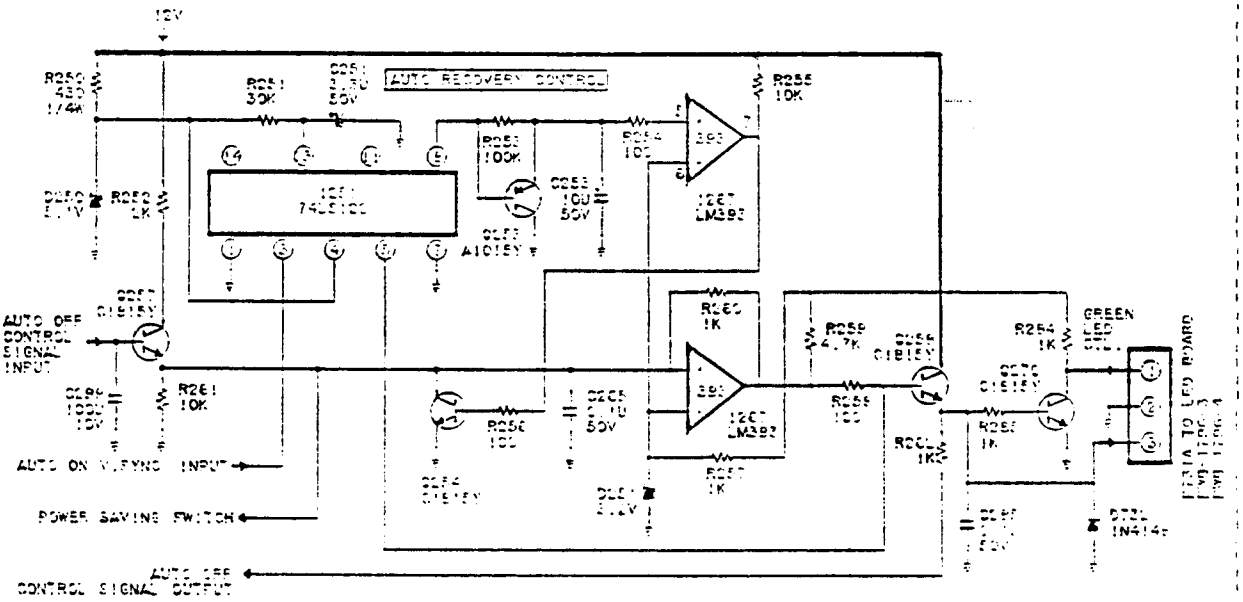
AUTO RECOVERY (Power Saving Mode)

The 'auto recovery' control signal (Vertical sync) is fed to Pin 3 of the monostable multivibrators I251, the value of the timing components R251 and C251 are chosen to make I251 as a retrigger circuit.

When input the vertical sync to Pin 3 of I251, a high level dc voltage will be generated at PiN 8, this dc voltage is fed to the reset transistor Q254 via buffer I267b. The state of I267a which is originally latched at high level output by R260. Now, it will be reset to low level output. The low level output is fed to Pin 1 of P506D, in order to release the shut down instruction. So, the main power will be ON again, it is called auto recovery.

Capacitor C253 is to limit the circuit noise, Q253/R253 is to discharge the voltage on C253. The green color of LED is lit by Pin 1 of P731A.

POWER SAVING (AUTO ON/OFF) CIRCUIT Fig-7



LOW VOLTAGE REGULATOR

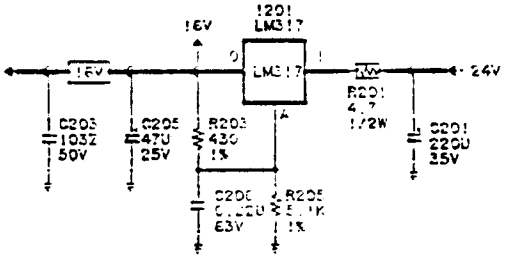
3.8 16V LINEAR REGULATOR (ON MAIN BOARD PWB-1785)

(Refer to circuit diagram Fig-8)

The 16V voltage supply is derived from network I201/R201/R203 C205/R205/C206.
I201 (LM317) is a three-terminal adjustable output positive voltage regulator ,the output voltage is controlled by the resistor divider R203 and R205.
Pin I of Q201 is the voltage input,pin A is the voltage adjust Pin,pin O is the voltage output pin.

R201 is a fusible protection resistor.

16V REGULATOR Fig-8



3.9 12V SWITCHING REGULATOR (ON VIDEO BOARD PWB-1796)

(Refer to circuit diagram Fig-9)

The 12V switching regulator is mounted on video board (PWB-1796) network I202/I221/Q214/Q216/Q231/Q223/T216 and some discrete components achieve a high efficient 12V switching regulator.

PWM (PULSE WIDTH MODULATION) GENERATOR

A square waveform signal is fed to Q231 via C231/R231, a ramp signal is generated by C232 with the peaks being clipped to 12V by D605.In order for the system to function correctly,the slope of the PWM reference signal is modified by Q233/D233.
The ramp signal is fed to pin 3 of I211, it is used as the reference signal for the Pulse Modulation Comparator.

I202 is an error amplifier, the dc feedback signal is fed to Pin 2 of I202 via R202/R208, the ac feedback signal is also fed to Pin 2 via R223 and C223 to improve a low ripple output.
The reference voltage on pin 3 is provided by R207/D202 and zener D203.

If there is any voltage difference on the output,it will be detected by the error amplifier.

Divider R202/R204/R206 with R204 enabling fine adjustment of the output voltage.
C209/R209/R210 optimize the stability of the control system by defining the loop gain of the Error Amplifier.

I221 is a comparator for PWM signal generation, a saw-tooth signal is fed to pin 3 via the collector of Q231, . the error voltage is fed to pin 2 via pin 1 of I202, the PWM (square waveform) pulses is generated from pin 1 of I221.

OUTPUT STAGE

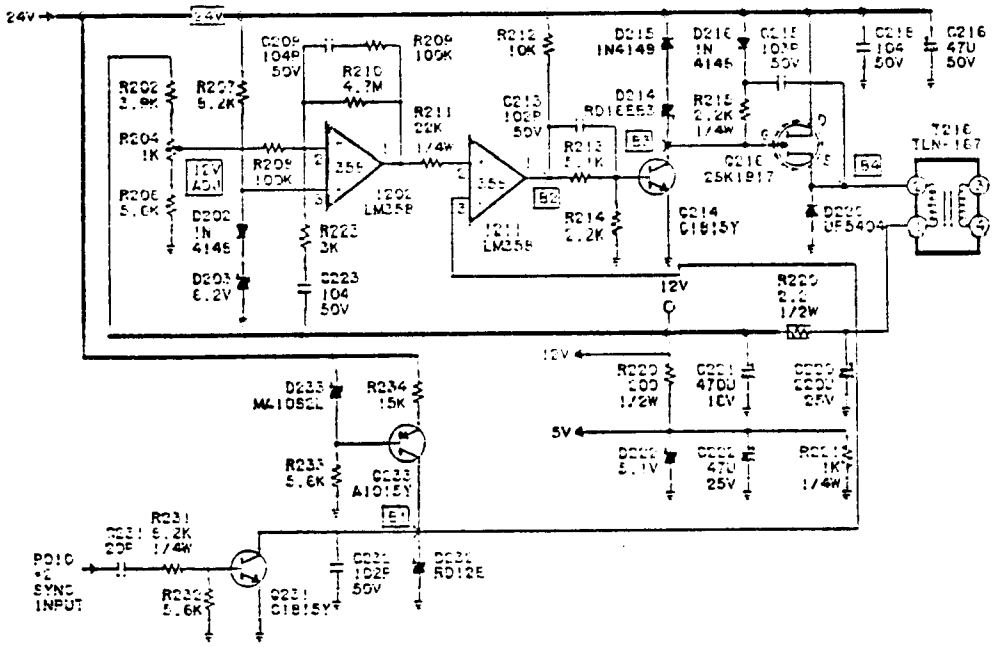
The drive signal is fed to the output stage via buffer stage Q214, Network D216/C155 is the voltage pump-up circuit to provided 40Vp-p signal on the collector of Q214, the signal is clipped by D215/D214.

Power MOSFETs Q216 switches the primary termination of T216 (Pin 1) between 0V and 24V with the PWM Switching signal at the horizontal frequency.
Varying the duty cycle of the switching signal, varies the time-average voltage across the winding, thereby controlling the output dc voltage.

D220 is a fly-wheel diode. When Q216 is on.voltage +24V will supply to pin 2 of T216 via Q216. simultaneously the energy will store in T216. When Q216 is off, the energy which originally

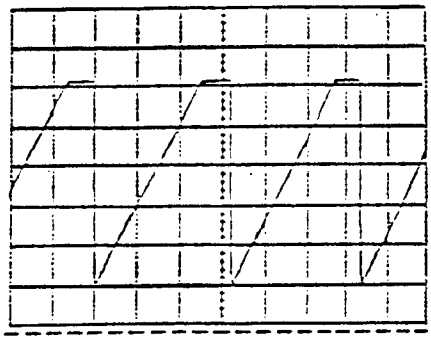
store in T216 will discharge to C206 via D220. R220/C221 is the decoupling circuit.

12V SWITCHING REGULATOR Fig-9

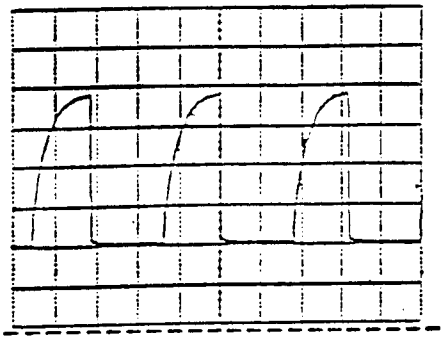


TEST CONDITION	TEST POINT	TEST POINT NAME
Fh=31KHz	B1	SAWTOOTH WAVEFORM
	B2	OUTPUT PULSE
	B3	GATE PULSE
	B4	SOURCE VOLTAGE

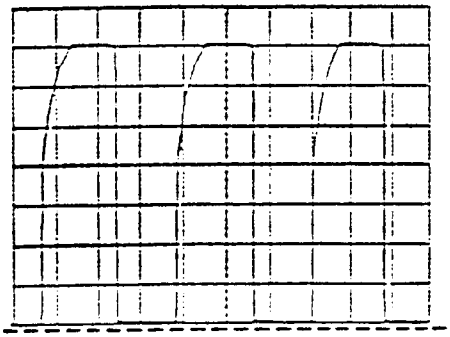
B1 10 Vpp



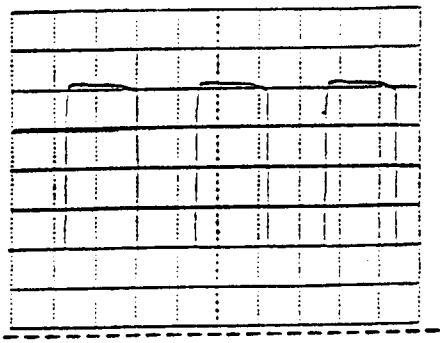
B2 9 Vpp



B3 35 Vpp



B4 22 Vpp



3.10 DEFLECTION CIRCUIT

The deflection circuit consists of the mode selection, horizontal oscillator, horizontal deflection, vertical deflection, position control, DPC control, dynamic focus and X-Ray protection circuit.

3.11 VERTICAL DEFLECTION CIRCUIT

(Refer to circuit diagram Fig-11)

The power amplifier driving the vertical yoke assembly is an AC design based on a single chip power amplifier module (TDA-1675A).

Vertical deflection coil is connected to the output (Pin 1) of I301 via R301. The ramp generator which is inside the TDA-1675A, generates a ramp signal on Pin 9, then send to the linearity circuit (Pin 10) via C305/R305/C306/R311/R306, it provides the adjustable frame linearity for product set up purposes. R311 enabling the fine adjustment of linearity.

The output of power amplifier from Pin 1 of I301 drives the vertical deflection coil by a negative slop current ramply, R309 and C309 are used to stabilize the power amplifier.

R307 and R310 define the dc level across C312, so, allowing a correct centering of the output voltage. R308 and C304 in conjunction with R307 and R310, applied at the feedback input Pin 12 of I301, a small part of the parabola, available across C312, and the AC feedback voltage, taken across R312.

Pin 14 is the main supply voltage (+24V) input. Pin 8 is the ground pin.

The supply voltage of the power stage is forced at Pin 2. During the trace time the voltage of Pin 2 is obtained from the main supply voltage via D301 ; while during the retrace time Pin 2 is supplied from flyback generator via C308 and Pin 15 of I301.

The vertical SYNC is applied to Pin 5 of I301 via R301/C302/R300 C303/R341/D341/R302 connected to Pins 3/4/6 determine the free-run frequency and pull-in range of the oscillator inside I301. The pull-in range is from 50 Hz to 120 Hz.

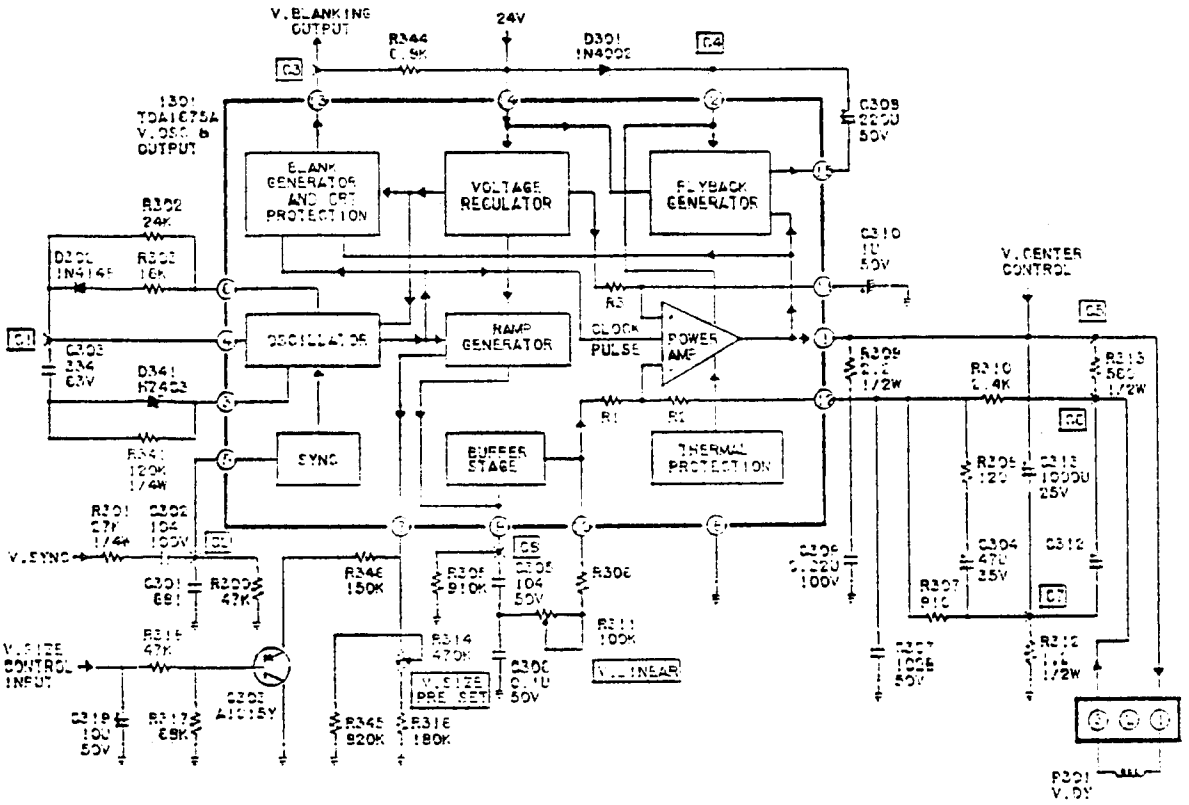
Pin 10 is the output of the buffer stage and it is internally coupled to the inverting input of the power amplifier through R1.

Pin 11 is the non-inverting input and it is not used.
Pin 13 is the output of the vertical blanking pulse. The width of the blanking pulse is controlled by R303.

VERTICAL DEFLECTION COIL SPECIFICATION

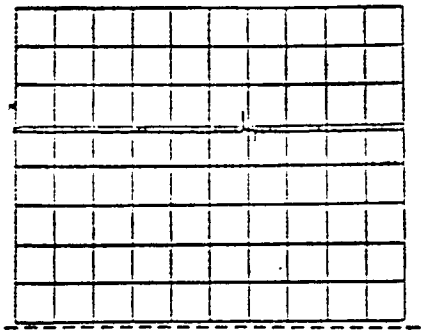
	HITACHI (17")	HITACHI(20")	NEC (17")	MITSUBISH
INDUCTANCE	5.3 mH	6.4 mH	6 mH	6 mH
RESISTANCE	6.8 ohm	6.7 ohm	6 ohm	6 ohm

VERTICAL DEFLECTION CIRCUIT Fig-11

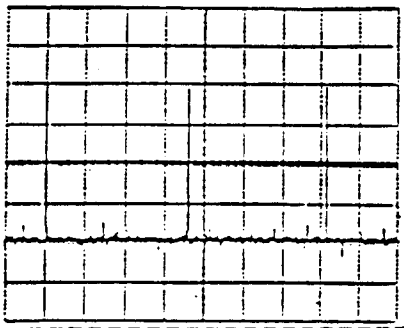


TEST CONDITION	TEST POINT	TEST POINT NAME
Fh=31KHz	C1	OSC VOLTAGE
	C2	V SYNC
	C3	BLANKING PULSE
	C4	PUMP-UP PULSE
	C5	V OUTPUT
	C6	FEEDBACK PULSE
	C7	FEEDBACK PULSE
	C8	BUFFER OUTPUT

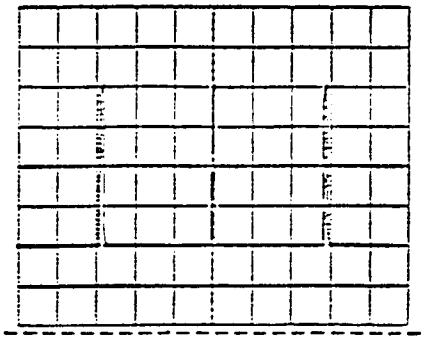
C1 0.3 Vpp



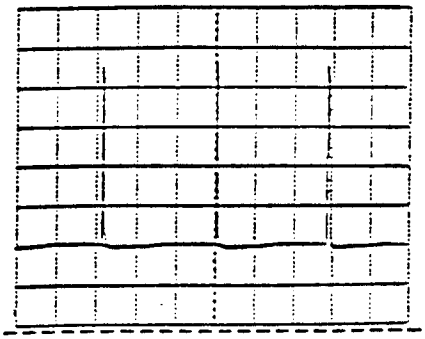
C2 0.8 Vpp



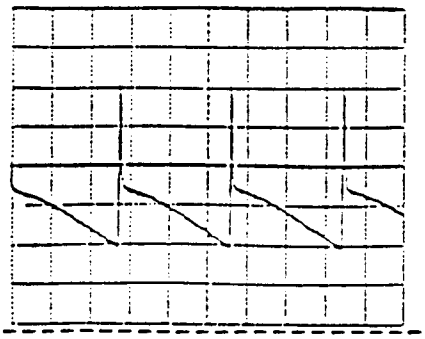
C3 20 Vpp



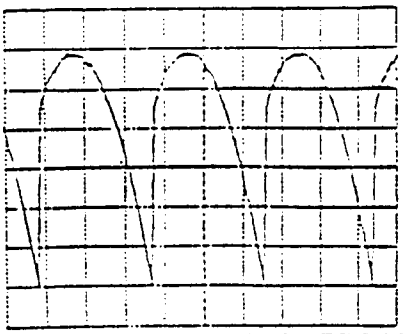
C4 23 Vpp



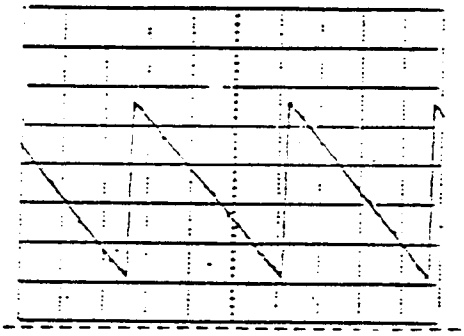
C5 43 Vpp



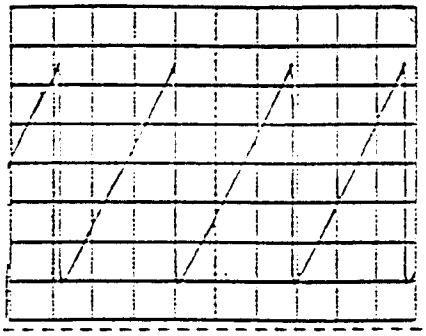
C6 3 Vpp



C7 2.3 Vpp



C8 11 Vpp



3.12 VERTICAL HEIGHT ADJUSTMENT

(Refer to circuit diagram Fig-11)

The resistance between pin 7 of I301 and ground defines the current mirror and then the height of the scanning.

R314 and network Q303/R346/R316/R345 define the amplitude of the ramp signal on the input of the deflection power amplifier. R314 is the vertical size pre-setting resistor.

When input voltage on the base of Q303 is higher, the dc resistance between the emitter and collector will be increased, as the result, the height of the scanning will be decreased.

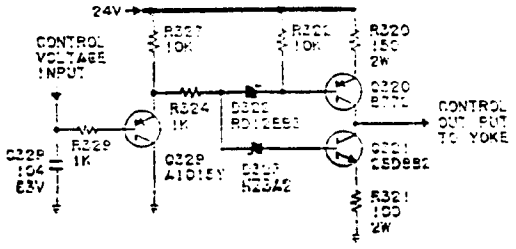
3.13 VERTICAL POSITION ADJUSTMENT

(Refer to circuit diagram Fig-13)

The adjustment of the raster's vertical position is achieved by using the network Q329/D322/D323/Q320/Q321/R320/R321, control voltage is fed to the base of Q329, when the voltage on the emitter of Q329 is higher, this voltage will turn on Q321 via D323, part of vertical deflection dc current will flow into ground via Q321 and R321, the raster position will be moving up.

Similarly, when output voltage on the emitter of Q329 is lower, this voltage will turn on Q320 via D322, part of dc current will flow into vertical deflection coil via R320 and Q320, the raster position will be moving down.

VERTICAL POSITION ADJUSTMENT Fig-13

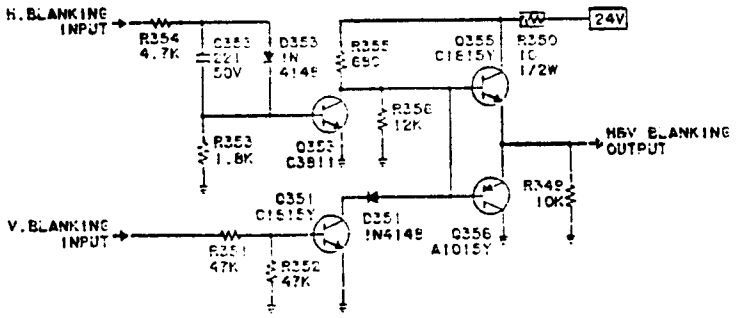


3.14 VERTICAL BLANKING CIRCUIT

(Refer to circuit diagram Fig-14)

The vertical blanking pulse is produced from pin 13 of I301 via R344, it is also combined with horizontal blanking signal via network D351/Q351/R351/C352. (Fig-20)

VERTICAL BLANKING CIRCUIT Fig-14



3.15 DPC (EASE-WEST CORRECTION) CIRCUIT

(Refer to circuit diagram Fig-15)

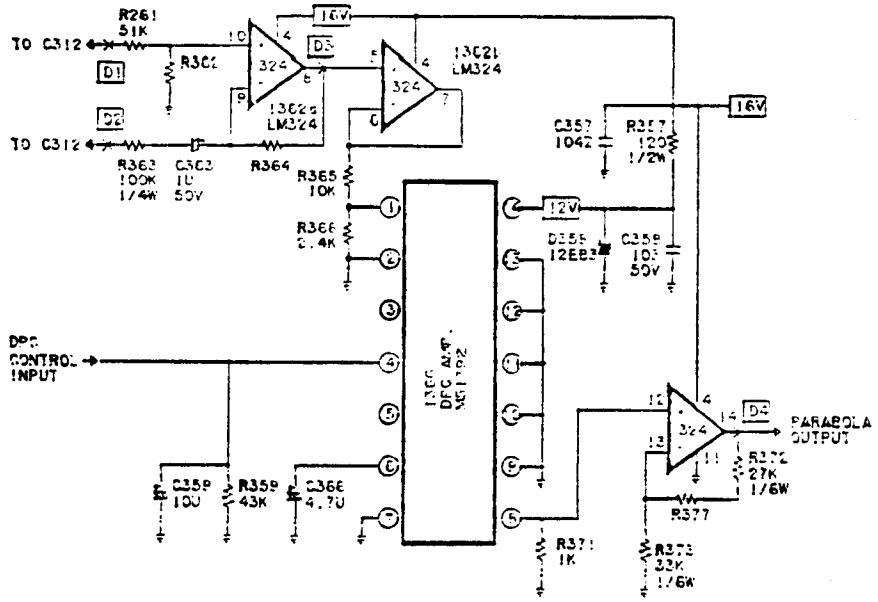
The East-West correction can be reached by modulating the horizontal yoke with a parabola. the parabola can be obtained directly from the coupling capacitor C312 in the vertical output stage.

Network I362a/I362b/R364 is introduced to generate the parabola signal. vertical saw-tooth (ramp) signal is fed to pin 9 of summing amplifier I362a via R363/C363, a DC signal is fed to pin 10 of I362a via R361/R362 to adjust the symmetry of the parabola signal. The output signal on Pin 8 of I362a is fed to Pin 5 of the buffer stage I362b.

A video amplifier I366 (M51392) being used here to amplify the parabola signal and control the signal gain with dc voltage. Pin 1 of I366 is the parabola signal input. the user control dc-voltage is fed to Pin 4 of I366, pin 8 is the output of the amplifier, the output is fed to second stage of amplifier I362c. R377 is used to set the amplitude of parabola signal, the output of the parabola signal is on Pin 14 of I362c.

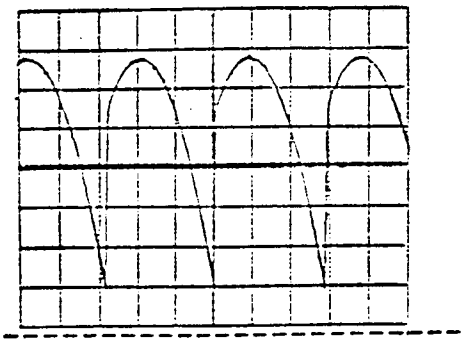
EAST-WEST CORRECTION CIRCUIT

Fig-15

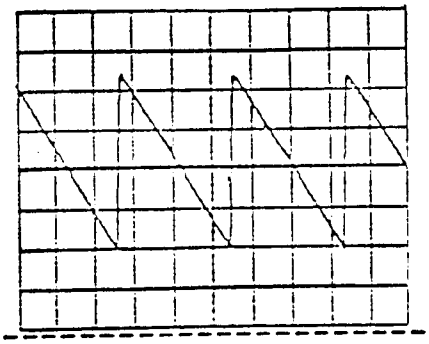


TEST CONDITION	TEST POINT	TEST POINT NAME
Fh=31KHz	D1	NON-INVERTING INPUT
	D2	INVERTING INPUT
	D3	PARABOLA OUTPUT
	D4	BUFFER OUTPUT

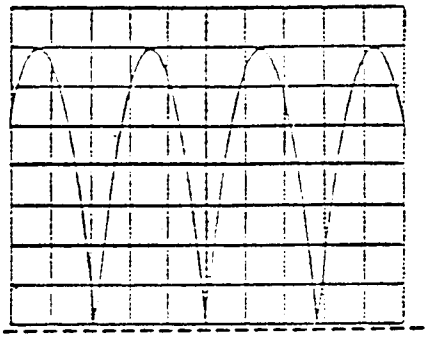
D1 3 Vpp



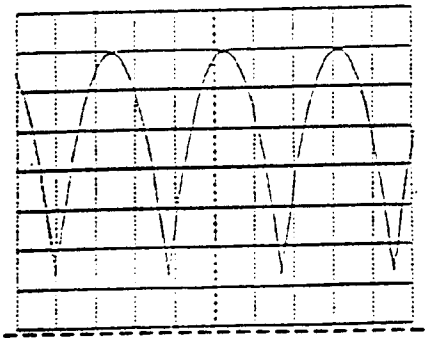
D2 2.3 Vpp



D3 7 Vpp



D4 5.5 Vpp



3.16 AFC/HORIZONTAL OSCILLATION

(Refer to circuit diagram Fig-16)

The function of the AFC (Auto Frequency Control) circuit is that it is used to synchronize the output phase of the horizontal deflection with the input phase of horizontal sync pulses.

The horizontal SYNC signal is fed to pin 1 of I428 via buffer Q443 and C429, the feedback reference signal of the horizontal deflection is fed to Pin 4 of I428 via R437/R438/D438.

The comparison sawtooth wave is generated on C432. A smoothing electrolytic capacitor C438 is connected to Pin 6 for the operating of phase comparison.

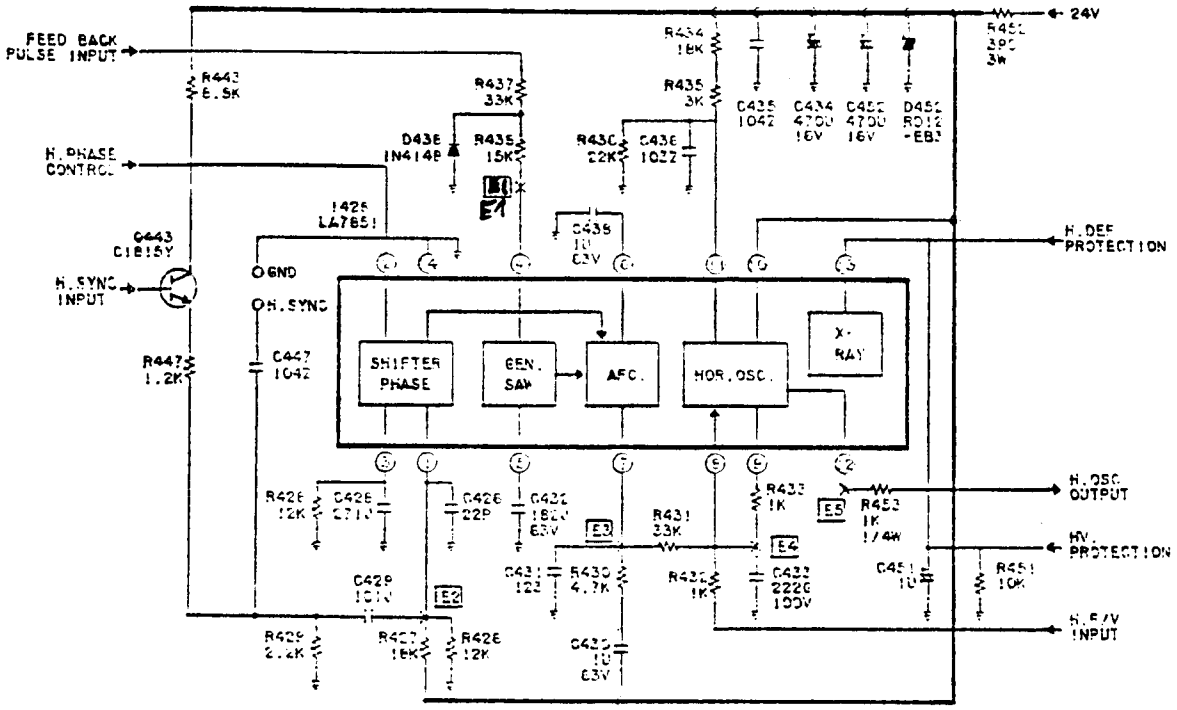
A AFC control signal is generated from pin 7, this signal is then applied to Pin 8 via R431, in order to control the phase of horizontal oscillation, if there is any phase difference between deflection output and sync input.

The horizontal oscillation circuit is a RC oscillation circuit that generates a sawtooth wave by charging and discharging the capacitor C433.

The oscillation frequency is determined by external charging resistor R432 or discharging resistor R433 or capacitor C433. The frequency is also automatically adjusted by a dc voltage which is generated form Horizontal F/V circuit via R432/Q419.

The oscillation output is a square wave and derived from pin 12 of I428, the duty cycle of the square wave is controlled by the dc voltage on pin 11 of I428, R434/R435/R436 being used to set up correct duty cycle.
Pin 10 of Q403 is the main input of supply voltage (12V) from zener D452 and R452.

AFC/HORIZONTAL OSCILLATOR CIRCUIT Fig-16

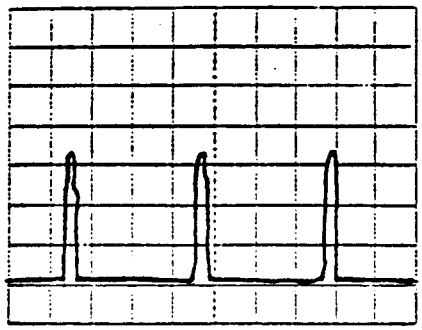


E1 * ④
E2 * ①
E3 * ⑦
E4 * ⑨
E5 * ⑫

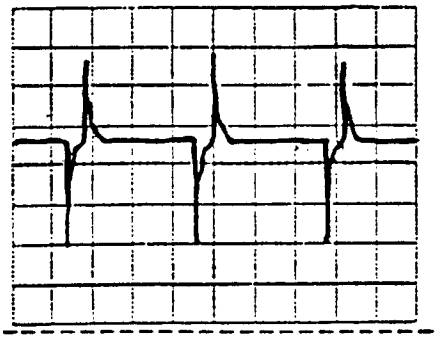
} IC428 LA7851

TEST CONDITION	TEST POINT	TEST POINT NAME
Fh=31KHz	E1	FEEDBACK PULSE
	E2	SYNC PULSE
	E3	AFC PULSE
	E4	AFC PULSE
	E5	OSC OUTPUT

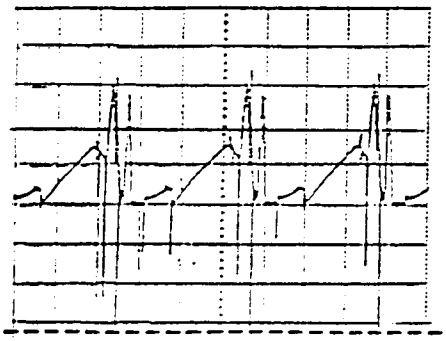
E1 1.8 Vpp



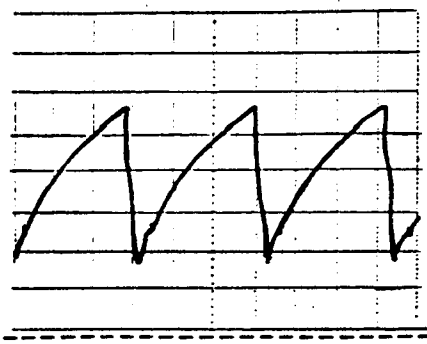
E2 4.5 Vpp



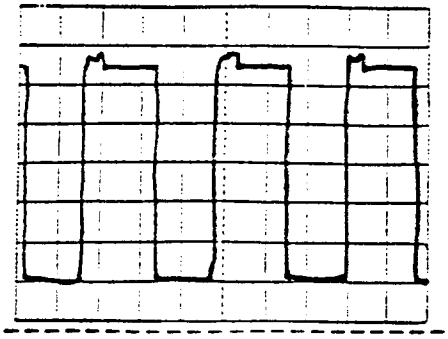
E3 0.35 Vpp



E4 4 Vpp



E5 12 Vpp



3.17 HORIZONTAL F/V CIRCUIT

(Refer to circuit diagram Fig-17)

The horizontal F/V circuit is consists of I420A/I420B/Q420C/I420D and some discrete components, The F/V signal is fed to Pin 10 of buffer stages I420C and I420D via Pin 2 of P502A, then the output voltage is applied to comparator I420B/I420A.

According to the different input frequency, the output voltage of I420B/I420A is fed to pin 8 of I428 via analog switch I401A/I401B and Q412/Q416.

For example:
When input frequency is between 28KHz to 40KHz, Pins 1 & 2, of I401A, Pins 3 & 4 of analog switch I401B are on. Q412/Q416 are off.

When input frequency is 40KHz to 63Hz, Pins 1 & 2 of I401A is on. Q412 is on.

When input frequency is 63KHz to 82KHz., I401A/I401B. are off, Q412/Q416 are on.

R408, R405 and R402 enable the free-run frequency to be tuned during the set up procedure.
For 81KHz, 62KHz and 28KHz mode, R408/R405 and R402 is adjusted respectively.

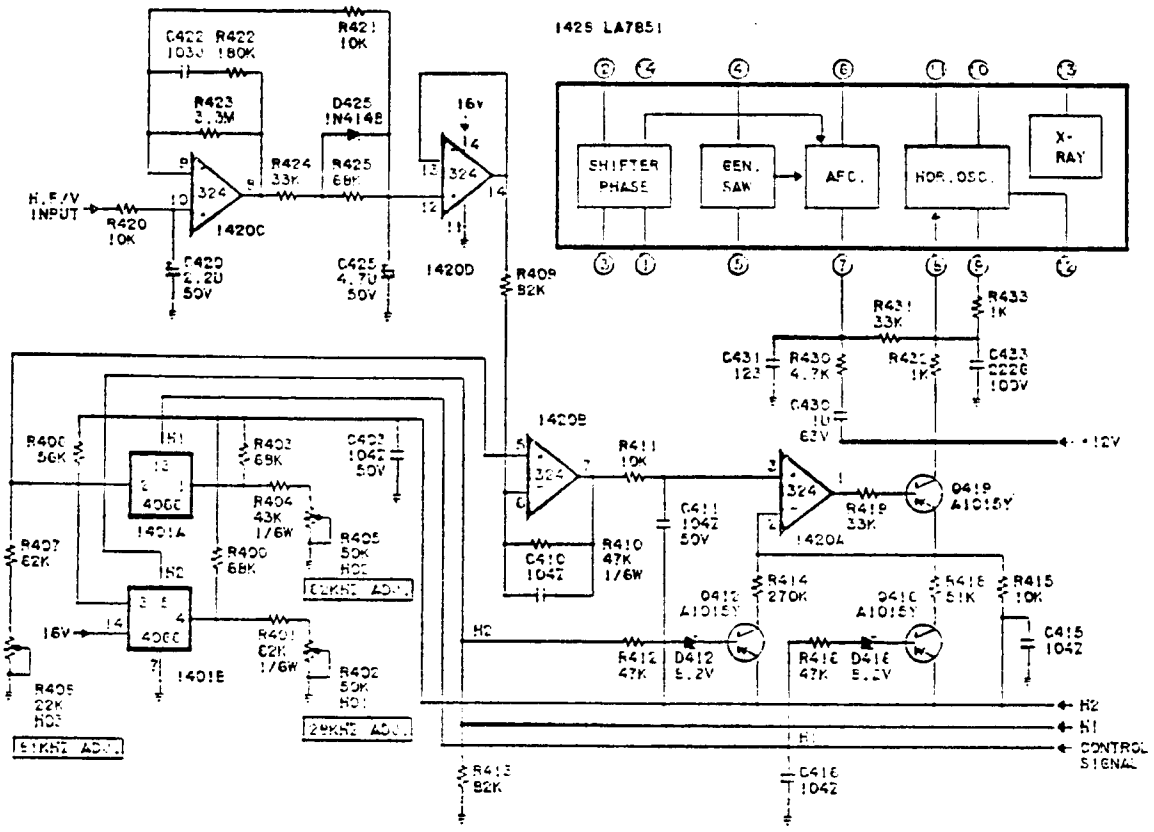
Note that the network values are chosen so that R402, R405 has negligible in the 81KHz mode and in the low frequency mode (28KHz or 62KHz), it adds to the effect of R408, therefore, during setup , it is advised that the high frequency operating modes be optimized first.

ALIGNMENT PROCEDURE

81KHz -----> 62KHz ----> 28KHz
(R408) (R405) (R402)

HORIZONTAL F/V CIRCUIT

Fig-17



3.18 HORIZONTAL PHASE SHIFT CIRCUIT

(Refer to circuit diagram Fig-18)

The phase shifter can be used to shift a display position right or left horizontally.

The phase shift control function is achieved by delaying the horizontal input sync signal, this job is done by using two stages of monostable multivibrators.

The circuit configuration is such that a on-chip circuit I428 LA7851 is adopted.

The input of the polarity detector of the Horizontal sync signal is on Pin 1, the next stage is a monostable multivibrator 1 having the time constant circuit at Pin 2, the third stage is a monostable multivibrator 2 having the time constant circuit at Pin 3, all the three stages are in series.

First, the polarity of the horizontal sync input signal is detected by stage 1 (polarity detector) to keep the correct edge trigging.

Secondly, the monostable multivibrator 1 is triggered by the leading edge of the input sync signal. The RC time constant is adjustable at Pin 2 of I428. This time constant of the monostable multivibrator 1 is the delay time of the sync input signal.

Third, A PSEUDO horizontal sync signal is regenerated at monostable multivibrator 2, it operates on the trailing edge of the pulse generated by monostable multivibrator 1.

The width of the pseudo horizontal sync signal is controlled by the RC timing constant R428/C428 on Pin 3 of I428.
This pseudo sync is then fed to the AFC circuit internally to generate the AFC control output signal.

In order to get wide control range of phase shift for different display mode. The dc control voltage is fed from micro board to phase shift circuit via Pin 7 of P502A.

The phase shift circuit is including I440A/Q449/I401c/I401d and relative parts.

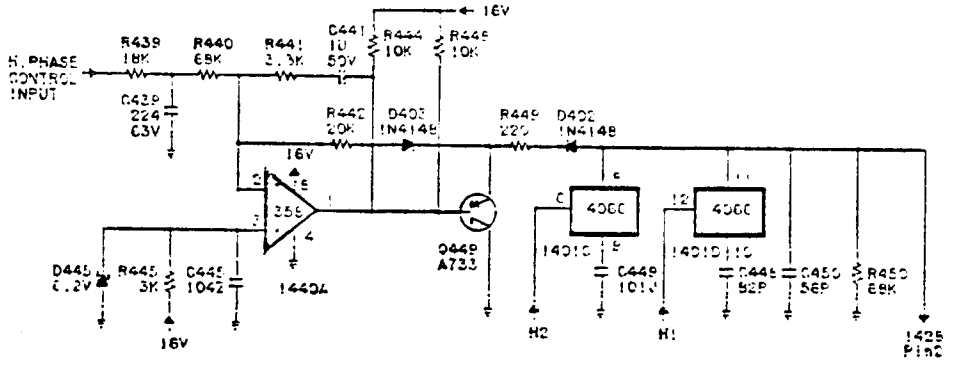
To get a good noise rejection for phase control, it is achieved by making use of the I440A/Q449 and relative components.

The output of the dc control voltage is fed to the base of Q449, the conduction situation of Q449 determines the resistance of the emitter & collector of Q449. So, the RC timing of phase control (Pin 2 of I428) is controlled by Q449.

For the frequency between 28KHz and 40KHz, analog switch I401C & I401D are on, in order to optimize the picture phasing in the low frequency operating mode.

For the frequency between 63KHz and 82KHz, analog switch I401C & I401D are off, in order to optimize the picture phasing in the high frequency operating mode.

HORIZONTAL PHASE SHIFT CIRCUIT Fig-18



3.19 HORIZONTAL DRIVE CIRCUIT

(Refer to circuit diagram Fig-19)

The product is designed around a base-drive circuit driving horizontal deflection (and HV. OUTPUT) circuit. to provide sufficient switching current.
Q456 is switched by the horizontal drive signal from I428 via network Q454/Q453. This produces a sufficient voltage to T467.
Snubber network R471/C471 compensates for leakage inductance in T467 and shapes the base drive waveform.

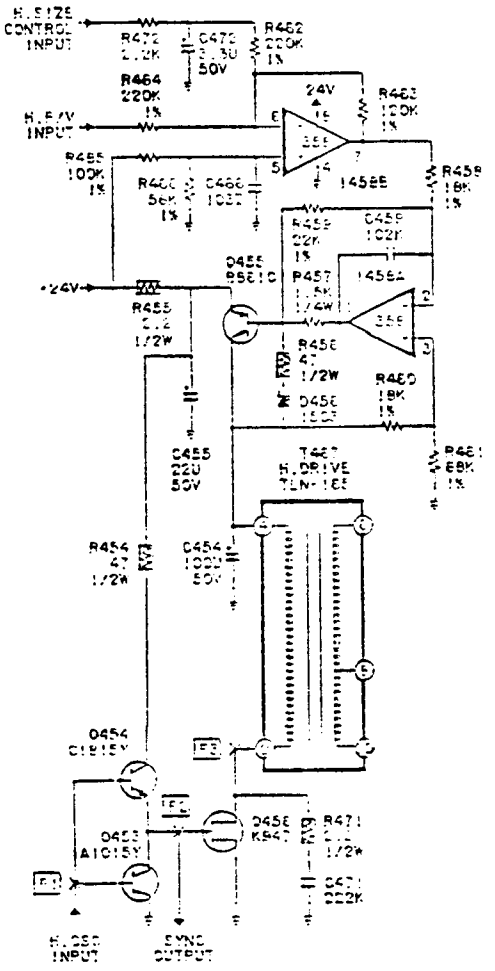
The drive current of Hor. output Q468 is automatically compensated by network Q455/I458A/I458B.

Pin 6 of I458A receives both the raster width control voltage via R462 and H. F/V dc voltage via R464, all the control signals are giving to the base of Q455 via Pin 1 of I458.

So, when the raster width or the horizontal frequency is changed, the primary windings of T467 will receive different drive voltage via Q455 automatically.
The result is that the current in secondary winding (Pin 6 & 10 of T467) is proportional to the primary drive voltage and horizontal frequency.

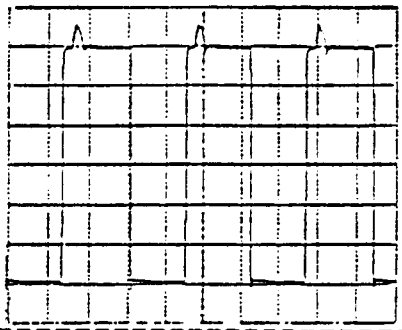
The drive voltage is fed to Q468 via D467/R467/R468/R469. When Q468 is at the 'OFF' state, the voltage which is stored on the base of Q468 is discharged via R470/D470, it is connected on Pin 8 of T467 to speed up the discharge operation of 'OFF' state.

HORIZONTAL DRIVE CIRCUIT Fig-19

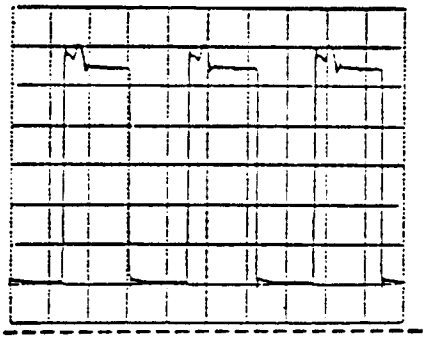


TEST CONDITION	TEST POINT	TEST POINT NAME
Fh=31KHz	F1	OSC VOLTAGE
	F2	BUFFER OUTPUT
	F3	DRIVE VOLTAGE
	F4	DRIVE VOLTAGE
	F5	OUTPUT PULSE
	F6	CS VOLTAGE

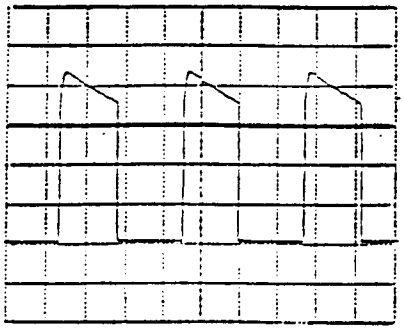
F1 12 Vpp



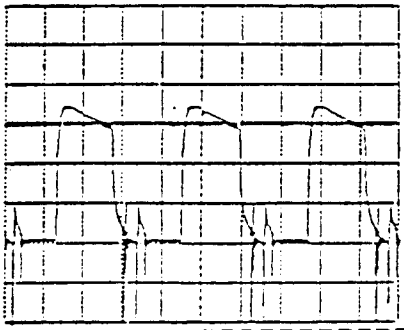
F2 12 Vpp



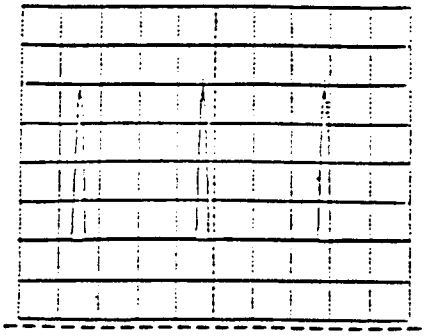
F3 42 Vpp



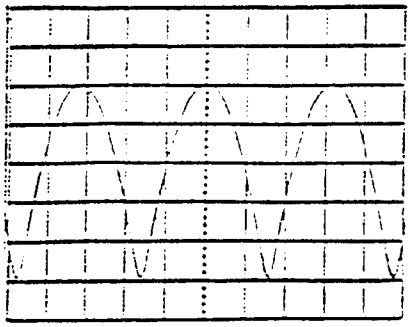
F4 12 Vpp



F5 840 Vpp



F6 25 Vpp



3.20 HORIZONTAL DEFLECTION CIRCUIT

(Refer to circuit diagram Fig-20)

The horizontal deflection output circuit uses the transistor's switching function, combined with a damping diode and makes sawtooth wave current flow through a deflection coil.

The basic deflection circuit comprises switching transistor Q468, transformer T468, damping diodes D468/D483/D469, Co capacitors C468/C469 and the horizontal deflection coil.

Pins 1 & 2 of T468 is the output of voltage pump-up coil. the output is connected to the deflection coil via Pin 1 of P404 to provide sufficient deflection current.

Pins 5 & 6 of T468 is connected to the collector of Q468, the pulse on the collector is lower than the pulse on Pins 1 & 2, it ensure Q468 is not only working at voltage safe area but also providing sufficient deflection current in the yoke.

Network D484/R484/C485/R485 is the snubber circuit to limit the noise on T468.

Network L486/L487, R486/C486, R487/C487, modifies the current waveform in the deflection coil to give a good horizontal linearity of the picture.

is : For the cross hatch pattern. the pattern width of the left edge equal to that of the right edge.

The switching operation of the linear coil L487

The control signal H7 is fed to the base of Q491 via Pin 7 of P504a. For the horizontal frequency between 28KHz and 42.9KHz, relay RY487 is off. Pin 3 & 4 of RY487 is open, the linear coil L487 is in series with linear coil L486, gives the maximum modification of the deflection current in the deflection coil.

Networks R486/C486 and R487/C487 are for decreasing the ringing of the linear coils L486 and L487.

The switching operation of the Cs capacitors C493 to C498

There are six pieces of capacitors (C493 to C498) connected to C492, every capacitor has its own control FET (Q493 to Q498). The control signal is fed to the gate of the FET. When the control signal is 'HIGH'(+12V), the FET will be ON, the capacitor which is connected to the drain of the FET will be grounded via the drain and source of the FET.

For the frequency between 28KHz to 32.9KHz, Q498 is ON. C498 is paralleled with C492.

For the frequency between 28KHz to 42.9KHz, Q497 is ON, C497 is paralleled with C492 and C498.
For the frequency between 28KHz to 52.9KHz, Q496 is ON, C496 is paralleled with C492/C498/C497.

Similarly, the frequency between 28KHz to 76.9KHz, Q493 is ON, C493 is paralleled with C492/C498//C497/C496/C495/C494.

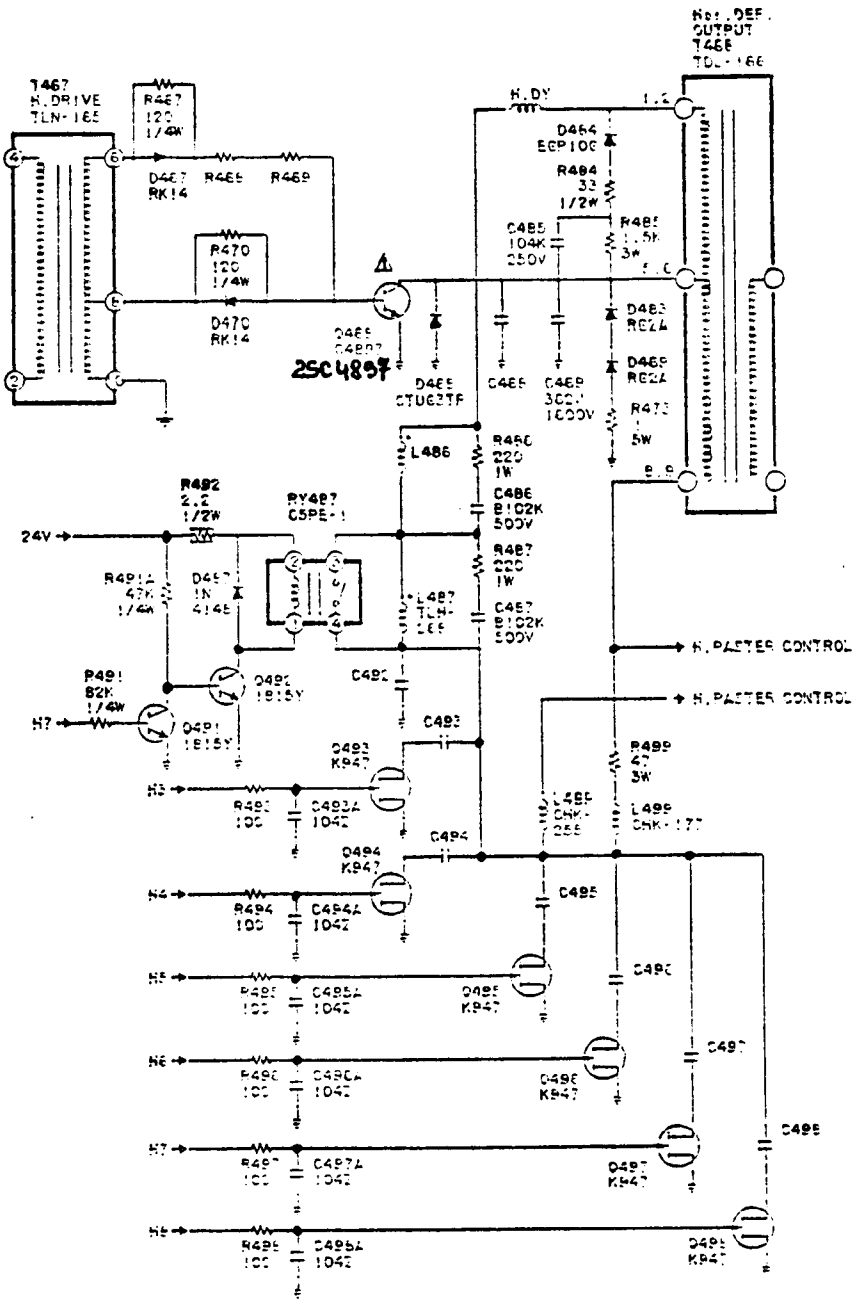
Ie : For the cross hatch pattern, the pattern width of the center area equal to that of the both edge area.

HORIZONTAL DEFLECTION COIL SPECIFICATION

	HITACHI (17")	HITACHI(20")	NEC (17")	MITSUBISH(17")
INDUCTANCE	0.13 mH	0.13 mH	0.13 mH	0.13 mH
RESISTANCE	0.21 ohm	0.3 ohm	0.3 ohm	0.34 ohm

HORIZONTAL DEFLECTION CIRCUIT

Fig-20



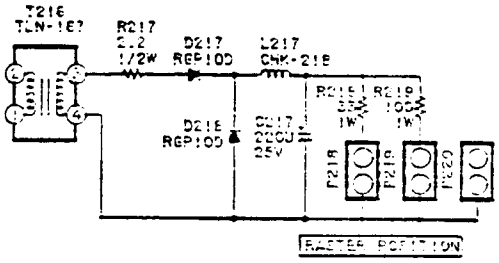
3.21 HORIZONTAL POSITION (RASTER)CIRCUIT

(Refer to circuit diagram Fig-21)

The adjustable horizontal raster centering is achieved by using the complementary voltage which derived from secondary winding T216 and network D217/D218/L217.

The horizontal position of the raster is achieved by selecting P218/P219/P220 on either end of the connector, the DC voltage (10V) produced across R218/ R219 introduces a DC current element in L489 and the yoke assembly. The background raster should be centralized with respect to the edges to the bezel during the set up procedure.

RASTER'S HORIZONTAL POSITION CIRCUIT Fig-21

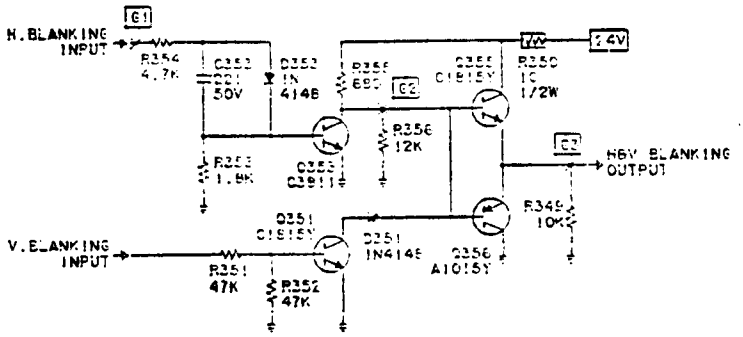


3.22 HORIZONTAL BLANKING CIRCUIT

(Refer to circuit diagram Fig-22)

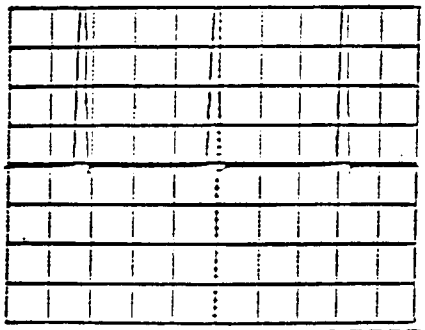
The secondary winding (Pin 4) of Horizontal output transformer T468, it is not only provides the signal of raster width control but also provides the signal of horizontal blanking.
The horizontal blanking is combined with the vertical blanking signal via Q353/Q355/Q356/Q351 to produce a composite blanking signal for the video amplifier.

HORIZONTAL BLANKING CIRCUIT Fig-22

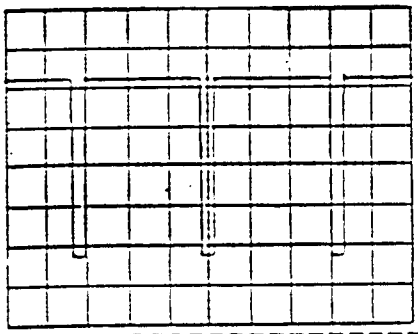


TEST CONDITION	TEST POINT	TEST POINT NAME
Fh=31KHz	G1	H PULSE
	G2	H BLANKING
	G3	H & V BLANKING OUTPUT

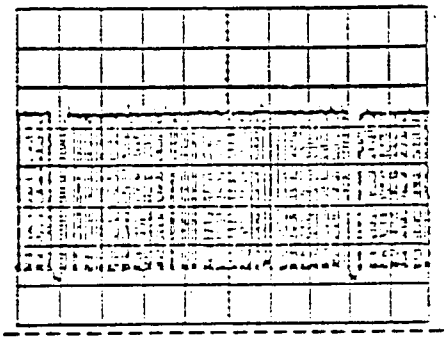
G1 42 Vpp



G2. 23 Vpp



G3 23 Vpp

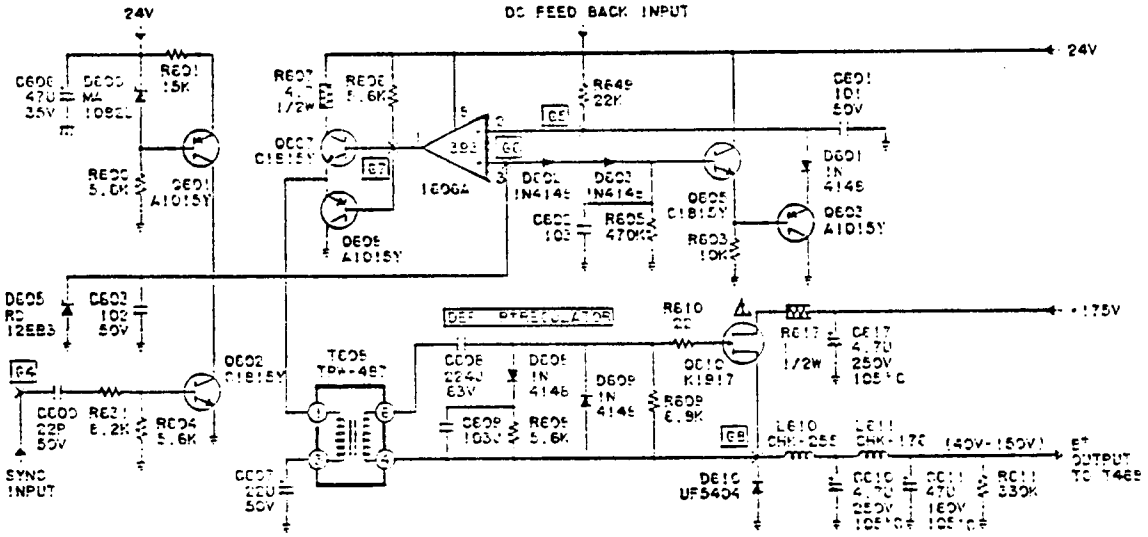


3.23 PWM SIGNAL GENERATOR

(Refer to circuit diagram Fig-23)

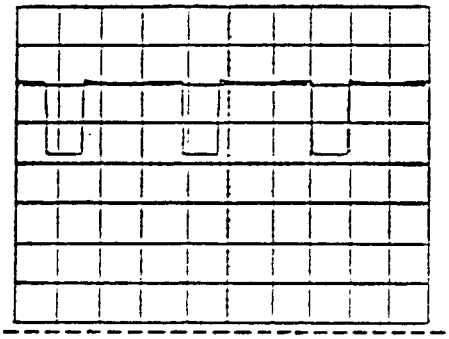
A square waveform signal is fed to Q602 via C600/R631, a ramp signal is generated by C603 with the peaks being clipped to 12V by D605. In order to function correctly, the slope of the PWM reference signal is modified by Q601/D600.
The ramp signal is fed to Pin 3 of I606A and pin 5 of I606B, it is used as the reference signal for the Pulse Modulation Comparator.

PWM SIGNAL GENERATOR CIRCUIT Fig-23

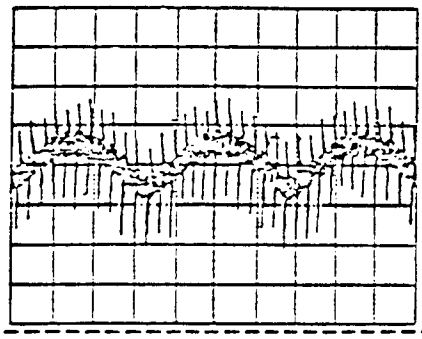


TEST CONDITION	TEST POINT	TEST POINT NAME
Fh=31KHz	G4	OSC VOLTAGE INPUT
	G5	H WIDTH FEEDBACK
	G6	SAWTOOTH WAVEFORM
	G7	PWM OUTPUT
	G8	SOURCE VOLTAGE

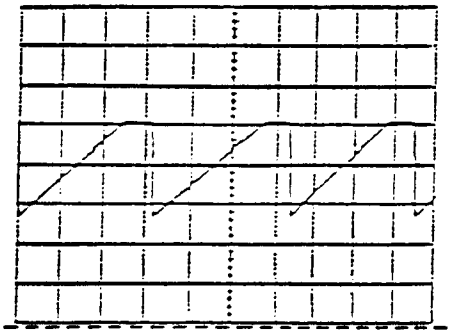
G4 12 Vpp



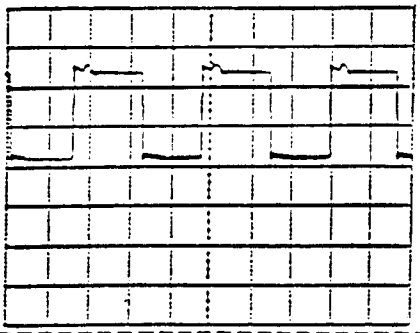
G5 0.8 Vpp



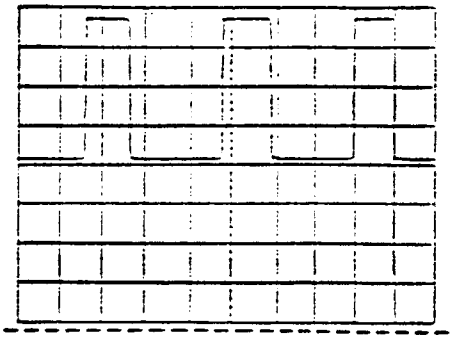
G6 12 Vpp



G7 23 Vpp



G8 173 Vpp



3.24 WIDTH CONTROL CIRCUIT(DC/DC CONVERTER)

(Refer to circuit diagram Fig-24)

This circuit supplies dc voltage (40-150V) to H deflection circuit,the output voltage level is proportion to H SIZE and horizontal frequency.

The width control circuit can be thought of as the error signal processing block of the feedback control loop.
The feedback signal is derived from the Pin 13 of T401 which is peak-detected by D637/C637. The width adjustment is applied at input through potential divider chain R637/R638/R639. R638 is used as a H. size pre-setting potentiometer.
The picture width should be optimize using R638 during the set up procedure.

The user horizontal size control is fed to Pin 6 of I638B via R472, it receives the size control signal from pin 6 of P502A.

The signal on pin 6 of I638B is the summary of DPC control signal (see DPC control generator), user size control signal and H. size pre-setting control signal.

The output of the summing amplifier I638B, therefore include EAST-WEST pincushion correction information. This signal is fed to Pin 2 of I606A via noise filter R649/C601, before comparison with the PWM reference signal, the sawtooth waveform signal being applied to Pin 3 of I606A.
Pin 1 is the output of the comparator I606A, the output is a square wave with pulse-width modulation and used to drive Q610 via buffer stage Q607/Q608 and T608. T600 is a isolating transformer used to isolate low voltage on primary side and high voltage on secondary side.

Network L611/C610/C611 is a decoupling circuit, R617 is a fusible resister. D608 and D609 are initial turn on diodes, to prevent transient instability on power up.

D610 is a fly-wheel diode, when Q610 is ON, voltage +176v will supply to Pin 8 & 9 of T468 via L611, simultaneously the energy will store in the choke L611. When Q610 is OFF, the energy which originally store in L611 will discharge to C611 via D610.

Power MOSFET Q610 switches the termination of L611 between 0V and 176V with a Pulse-Width Modulated Switching signal at the horizontal frequency.

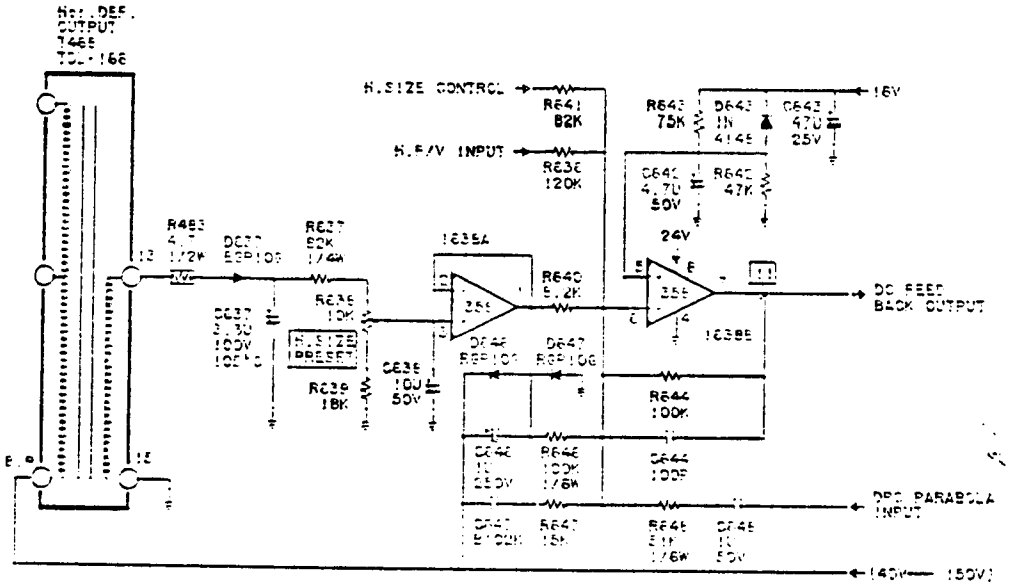
Varying the duty cycle of the switching signal, varies the time-average voltage of the output, thereby controlling the width of any horizontal scan cycle.

A dc voltage from 40V to 150V is generated from C611, this voltage is varied according to the H. SIZE dc feedback signal Pin 3 of I638A.
Network Q603/Q604/Q605, D601/D602/D603/D604 is a initial turn on circuit and used to force I606A generate a PWM signal before Pin 13 of T401 is ready to generate a feedback control signal on power up.

Network D646/D647/C646/R646. C647/R647 is a negative feedback circuit and used to limit the excursions of the error voltage upon the PWM reference to prevent instability on power up.
The width of the raster is proportional to the peak scan current in the deflection coil and different horizontal frequencies.

Therefore, if there is the scan period changes ,the voltage across the winding (Pin 13 of T468) will change to maintain a constant scan width.
A variable voltage (40-150V) which is generated from PWM SIGNAL GENERATOR is fed to Pins 8 & 9 of T468 to maintain the constant scan width.

WIDTH CONTROL CIRCUIT Fig-24



3.25 HIGH VOLTAGE CONTROL CIRCUIT(DC/DC CONVERTER)

(Refer to circuit diagram Fig-25)

This circuit supplies a dc voltage (40-150V) to HIGH VOLTAGE 1 circuit, the dc voltage is proportion to high voltage and horizontal frequency.

As shown by functional circuit diagram, the high voltage 1 control circuit is similar to the width control circuit.

The feedback signal of high voltage 1 regulation is derived from Pin 7 of T662 and R629 to give a good high voltage static regulation.

The high voltage 1 (See alignment) is set by potential divider chain R629/R628/R627, the feedback voltage is fed to Pin 5 of of buffer stage I622B, the output of I622B is fed to pin 2 of summing amplifier I622A through R625.

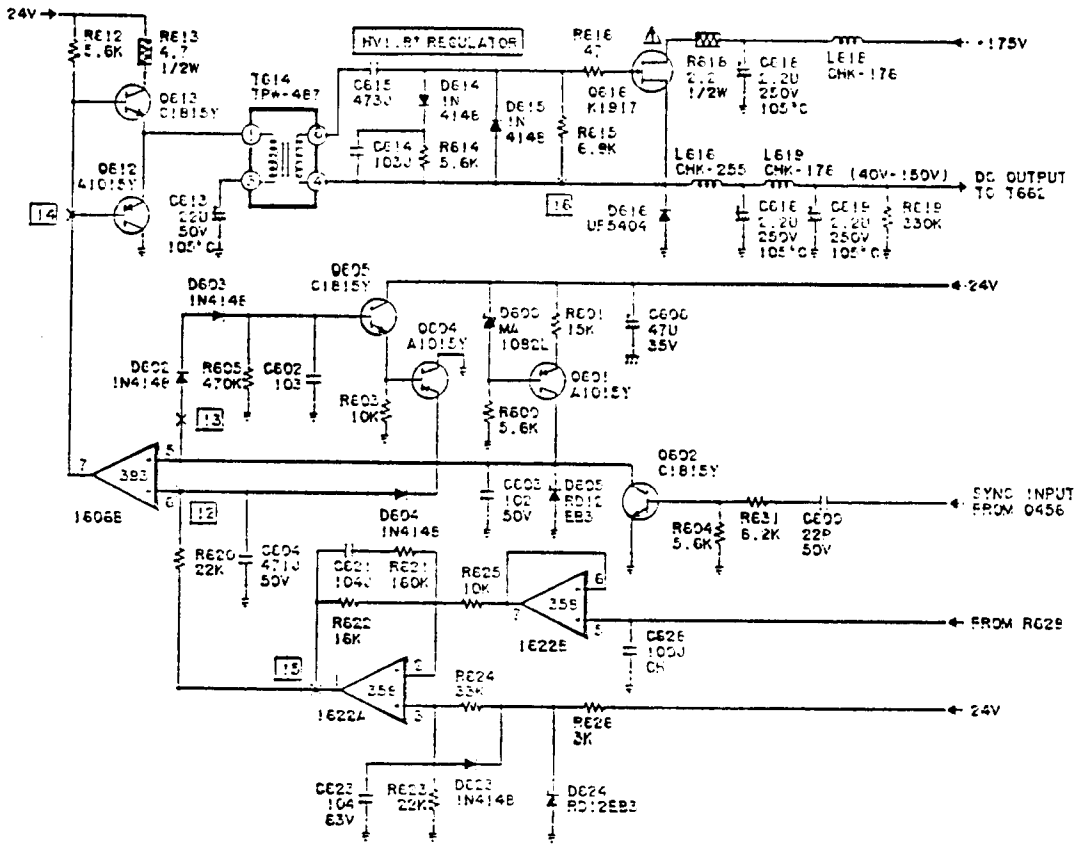
The voltage on the output of I622A is the error signal which is compared to the PWM reference voltage by I606B. The square wave output of comparator I606B is used to drive the MOSFET Q616 via buffer stage Q612/Q613 and isolating transformer T614.

Varying the duty cycle of the switching signal (PWM), varies the time-average voltage (Pin 8 of T662) across the primary winding, thereby, controlling the high voltage during any one horizontal cycle.

A voltage from 40V to 150V is generated from C619, this voltage is varied according to the HV. dc feedback signal (Pin 5 of I662B).

HIGH VOLTAGE CONTROL CIRCUIT

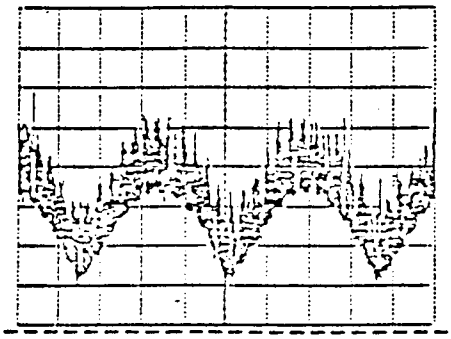
Fig-25



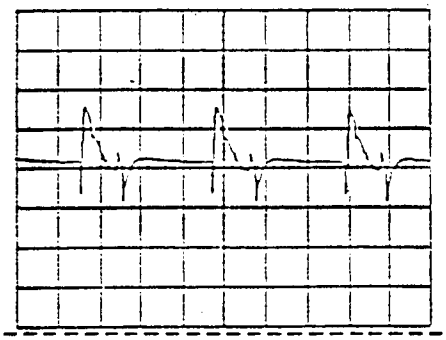
F16-25

TEST CONDITION	TEST POINT	TEST POINT NAME
Fh=31KHz	I1	HV FEEDBACK
	I2	HV FEEDBACK
	I3	SAWTOOTH WAVEFORM
	I4	PWM DRIVE SIGNAL
	I5	HV FEEDBACK
	I6	SOURCE VOLTAGE

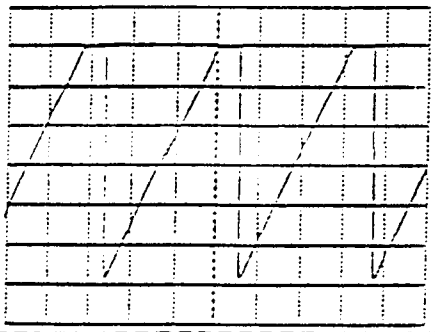
I1 0.42 Vpp



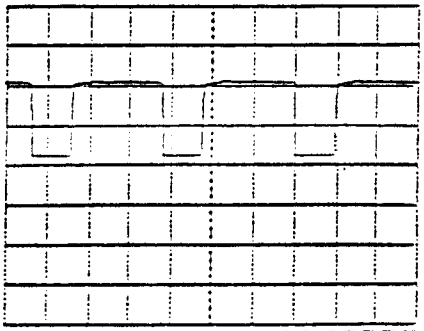
I2 1.2 Vpp



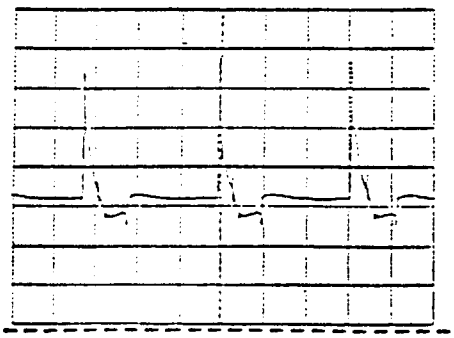
I3 12 Vpp



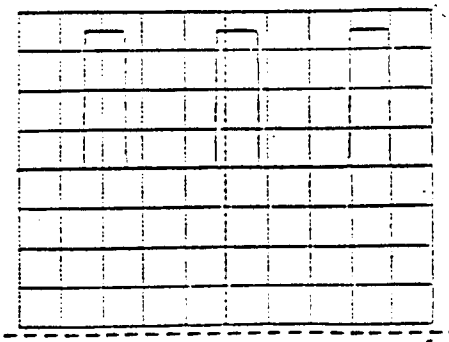
I4 24 Vpp



I5 2 Vpp



I-6 173 Vpp



3.26 HIGH VOLTAGE (HV.) GENERATOR

(Refer to circuit diagram Fig-26A)

There are two high voltage generator in this monitor, one is the high voltage 1 which is generated by T662, the other is the high voltage 2 which is generated by SR transformer T662A.

The voltage of the high voltage 1 is around 24KV, it is the basic high voltage supplier for the CRT (Cathode Ray Tube). In order to get a very good dynamic high voltage regulation, the SR transformer circuit is introduced.

The voltage of the high voltage 2 is around 3 KV, the function of the circuit is that it has quick action for the dynamic changes of the picture brightness, the response of the high voltage is almost to every line of the horizontal deflection. So, the result is that a very good dynamic & static regulation is achieved.

These two kinds voltage are in series (HV= HV1 + HV2) at the output to form the total high voltage around 25KV (See Alignment).

HIGH VOLTAGE 1

The drive signal from Q453 and Q454 is fed to pin 3 of I650 to generate a constant width of drive waveform in order to drive Q662 via Q658/Q657/Q656/Q654 and T661.

The HV. generating circuit uses the same principle as the horizontal deflection stage. The base-drive circuit (see horizontal deflection circuit) includes a current on the winding between pins 6 and 10 of T661 which is sufficient to switch Q662.
The flyback pulse thus produced across Pin 10 of T662 is transformed up to the high voltage. The basic flyback comprises Q662, T662 primary winding, C662 and damping diode D662.

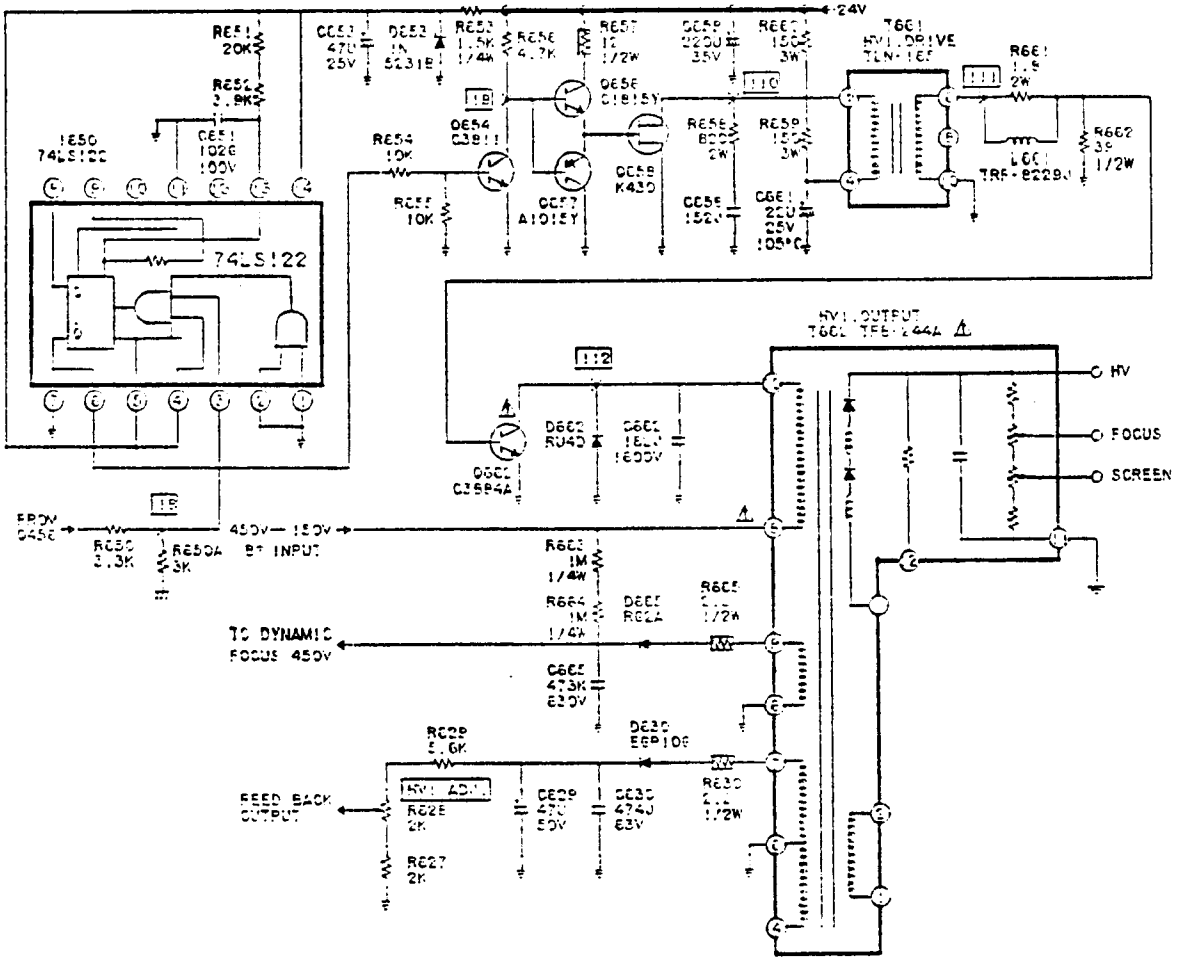
The high voltage is dependent on the amplitude and frequency of the flyback pulse. The frequency is set to the horizontal scan rate. Therefore, the high frequency operating mode would generate a high voltage if regulation measure were not taken.

Network L619/C616/C619 is a decoupling circuit, R618 is a fusible resister. D614 and D615 are initial turn diodes, to prevent transient instability on power up.

When Q616 is on, the voltage (+176V) is fed to L619 via Q616, the energy will store in the choke L619. When Q612 is off, the energy which originally store in L619 will discharge via D616 to C619 and supply to Pin 8 of T662 via L619. D616 is a fly-wheel diode.

HIGH VOLTAGE 1 GENERATOR

Fig-26A



HIGH VOLTAGE 2

(Refer to circuit diagram Fig-26B)

The high voltage 2 is generated by T662A, the output voltage is added to the voltage of high voltage 1.

The circuit composes of error amplifier I682A/I683, PWM signal generator I691A, buffer Q694/Q693 , MOSFET Q697, SR transformer T662A and relative components.

The amplitude of the feedback signal (Pin 2 of T662A) is clipped at 8.2V by D687, then is fed to Pin 3 of I691A via differential parts C688/R688 to get a slop waveform signal. The signal is dc clamped to a certain dc level which is controlled by the output (Pin 1) of the error amplifier I682A via D689/I683.
The reference voltage on Pin 2 of I691A is fixed at 13.2V by D691/R690.

The controllable PWM output signal is derived from Pin 1 of I691A, it is fed to the switching MOSFET Q697 via buffer Q694 and Q693.

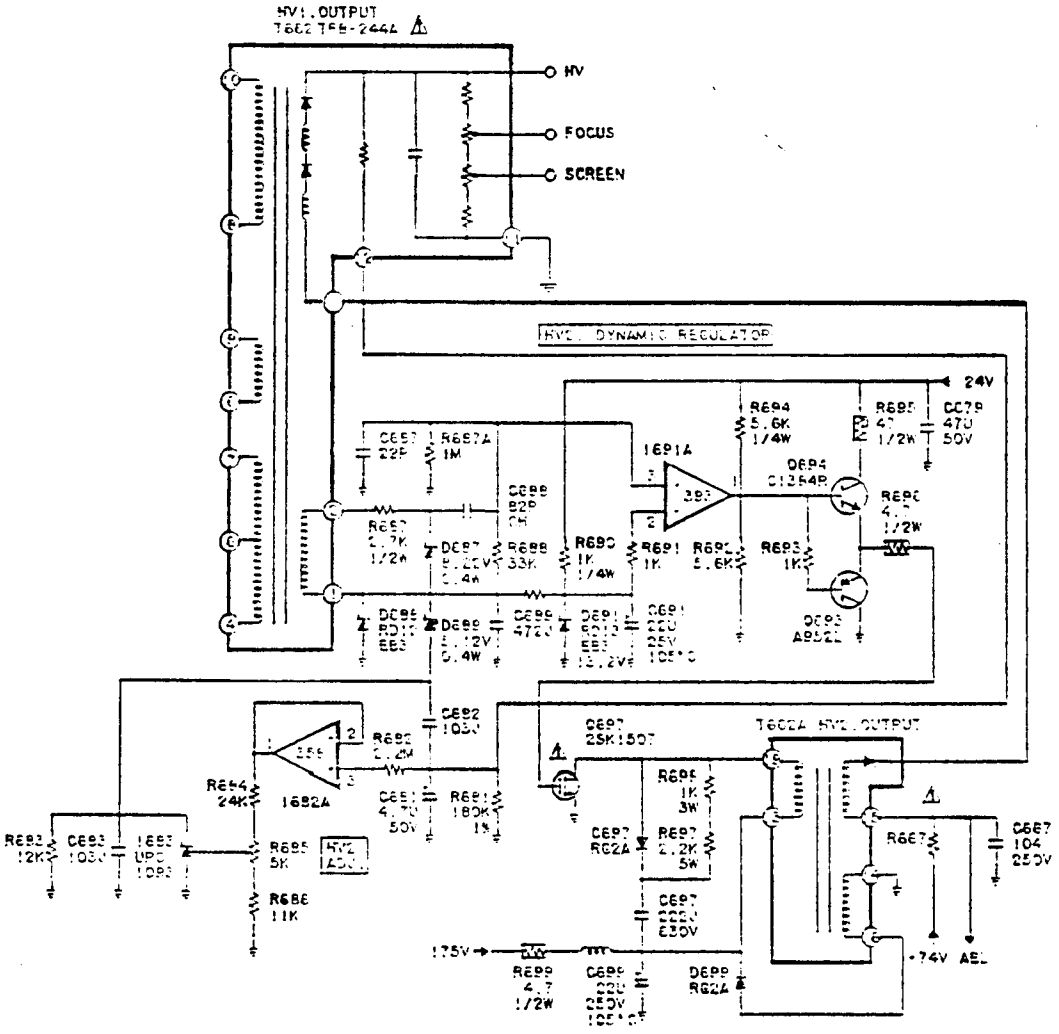
A dc voltage (+176V) is fed to the drain of Q697 via Pins 13 & 19 of T662A. Thus, the high voltage 2 is generated by the switching operation of Q697 and T662A.

Network C687/R687 and snubber circuit D697/C697/R697/R698 are to limit the circuit noise, D699 and Pins 14 & 16 are start-up auxiliary components. R699 is a fusible resistor to protect the FBT & Q697 during abnormal situation.
I683 Upc1093 is a three-terminal programmable shunt regulator diode. Any voltage change at the control Pin R (Reference), the regulation voltage between Pins K & A will be changed.

This regulation system also maintains good picture geometry compensating for high voltage stress effects during extreme changes in beam current.

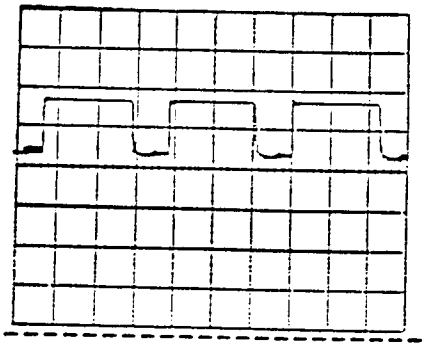
HIGH VOLTAGE 2 GENERATOR

Fig-26B

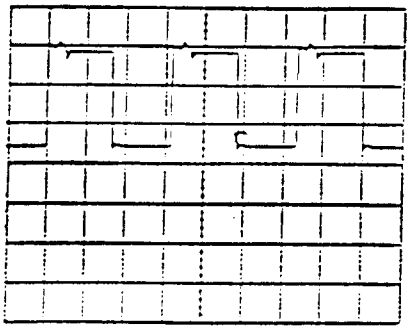


TEST CONDITION	TEST POINT	TEST POINT NAME
Fh=31KHz	I7	OSC VOLTAGE OUTPUT
	I8	OSC VOLTAGE INPUT
	I9	HV DRIVE INPUT
	I10	HV DRIVE OUTPUT
	I11	BASE VOLTAGE
	I12	COLLECTOR VOLTAGE

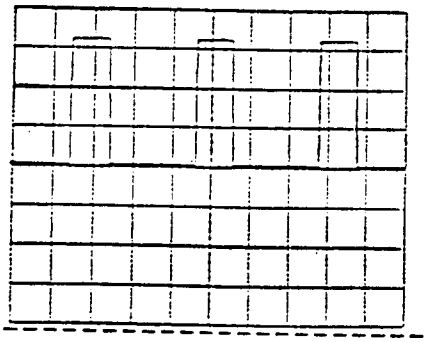
I7 0.7 Vpp



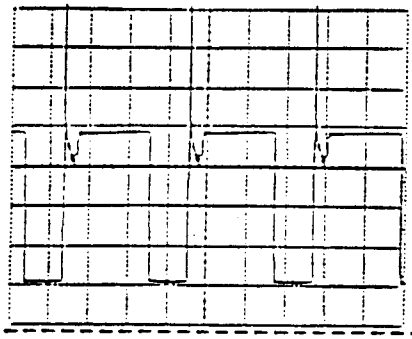
I8 5 Vpp



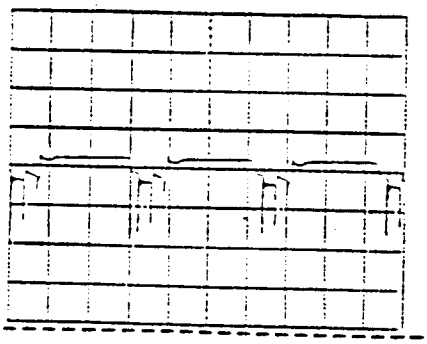
I9 16 Vpp



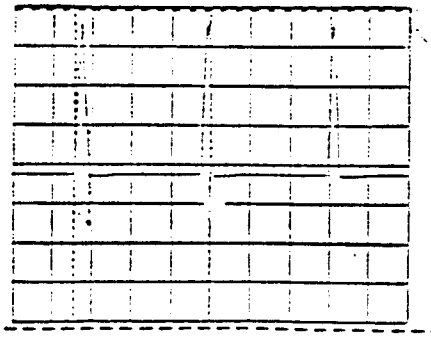
I10 20 Vpp



I11 10 Vpp



I12 800 Vpp



3.27 HIGH VOLTAGE PROTECTION CIRCUIT

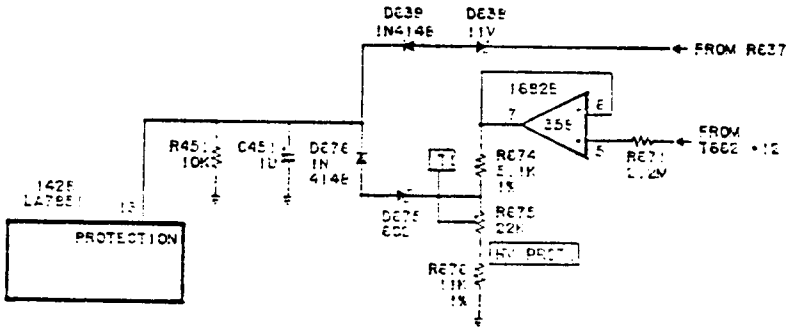
(Refer to circuit diagram Fig-27)

The high voltage protection circuit is triggered when the voltage is grossly over voltage and liable to cause harmful X-ray emissions from the CRT. The voltage on R681 produces a dc feedback voltage, it is proportional to the final anode voltage.

The feedback voltage is also fed to the protection circuit D675 via buffer I682E and divider R674/R675 and R676, R675 determines the protection voltage.

In the normal operation region, D675 is off. Above the upper limit ,the voltage is sufficient to cause zener diode D675 to conduct, Pin 13 of I428 is triggered. I428 is held off.
Pin 13 is also controlled by the output of horizontal deflection (Pin 4) of T468 via D638/D639. Potential divider R637/R638/R639 determines the protection voltage.

HIGH VOLTAGE PROTECTION CIRCUIT Fig-27



3.28 SYNC SIGNAL (HOR. AND VERT. SYNC) PROCESSOR

The product is designed to be compatible with workstation, computer or adapter card having the different sync signal such as G+SYNC, COMPOSITE SYNC or SEPARATE SYNC signals.

The following signals are the possible sync input signals.

(1) SYNC ON GREEN	NEGATIVE POLARITY
(2) COMPOSITE SYNC	POSITIVE/NEGATIVE POLARITY
(3) SEPARATE SYNC	POSITIVE/NEGATIVE POLARITY

A twenty pins IC M52036SP is adopted in the sync processing circuit, all the three possible sync signals are fed to this chip. Each time, only one of the signals will be chosen by the sync processor, the priority of the input sync signals are designed as following.

SEPARATE SYNC (H/V) > COMPOSITE SYNC (H+V) > G+SYNC

G+SYNC (GREEN+SYNC) SIGNAL

(Refer to circuit diagram Fig-28)

The G+SYNC signal is fed to Pin 4 of the sync processor I101 via Q031/S102/C105.

The sync signal which consists of vertical sync and horizontal sync signals is separated from green signal via internal stage of I101. After separation, these two sync signals are so called composite sync of the green signal.

Then, the separation process of the H sync & V sync from this composite sync signal is the same as that of the normal composite sync input signal (input from Pin 6 of I101).

R104 and C104 on Pin 3 of I101 are the Green separate filter.

COMPOSITE SYNC

The COMPOSITE SYNC is fed to Pin 6 of I101 via R107/C106/I102a and S102, the capacitor C107 on Pin 7 is a filter for polarity and no input detection, as it becomes larger, ripples become smaller to reduce misoperation but response time for detection gets slower.

Pin 14 is the H SYNC signal output of I101. Although this pin is defined H SYNC output only, for the COMPOSITE SYNC signal input, the output signal is also consists of V SYNC.

The V SYNC is derived from Pin 13 of I101 via Pin 14 and network R113/C112/R112/C111/R111 and Pin 11. the R-C value of the network is chosen to be a low-pass filter so that only vertical sync could pass to Pin 11.

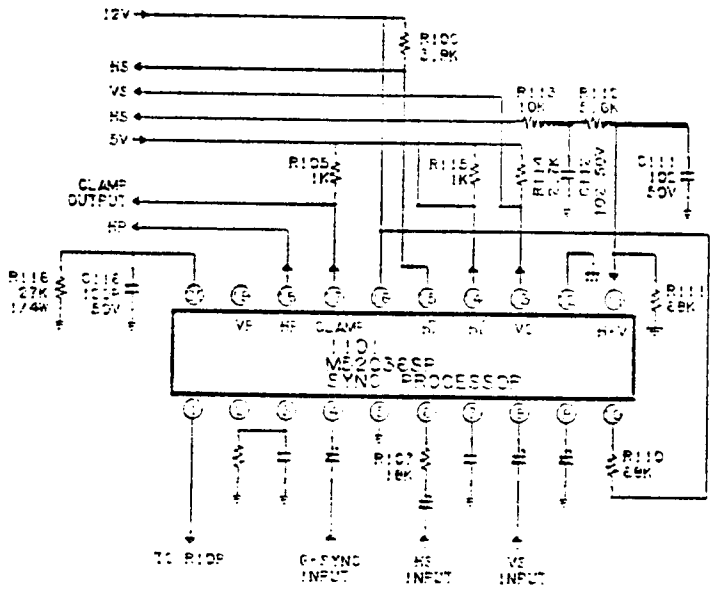
There is a analog switch in I101 for vertical sync selection, the output of the analog is connected to Pin 13, there are two inputs, one is the vertical sync from Pin 11, the other one is the vertical sync from Pin 8, the select signal is connected to Pin 2 internally.

Similarly, there is a analog switch in I101 for vertical sync selection, the output of the analog is connected to Pins 14 & 15 ,there are two inputs, one is the horizontal sync from Pin 4, the other one is the horizontal sync from Pin 6, the select signal is connected to Pin 1 internally.

SEPARATE SYNC

The SEPARATE V SYNC is fed to Pin 8 of I101 via C108/I102a/I102c, the function of C109 is the same as C107.

SYNC SEPARATOR CIRCUIT Fig-28



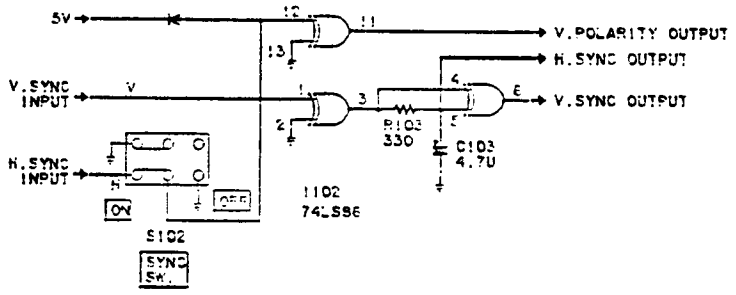
3.29 V SYNC POLARITY DETECTION CIRCUIT

(Refer to circuit diagram Fig-29)

The EXOR gate I102b/I102c and low-pass filter R103/C103 achieved the polarity detection function, R103/C103 extracts vertical sync polarity by removing the pulses.

When positive vertical sync input. The output of the circuit (Pin 5 of I102c) is low (0V). When negative vertical sync input. The output of the circuit is high (+5V). EXOR gate I102c with the pulse train (on Pin 4) to provide a " Normalized", POSITIVE-GOING sync signal, the positive vertical sync is derived from Pin 6 of I102c.

V SYNC POLARITY DETECTION CIRCUIT Fig-29



COMPOSITE SYNC (H+V)/H SIGNAL

The composite sync or H sync is fed to pin 2 of the buffer stage Q562a via pin 2 of P504,in order to get the positive sync from the output stage (pin 6 of Q562b), the H SYNC POLARITY DETECTION circuit is introduced. The output of the polarity detection signal is fed to EXOR gate Q562b to get the positive H+V or horizontal sync output from pin 6 of Q562b,no matter the input polarity of the vertical sync on pin 4.

SEPARATE SYNC (H/V) SIGNAL

The horizontal sync is fed to buffer stage Q562a via pin 2 of P504 and then fed to the H SYNC POLARITY DETECTION to get the positive horizontal sync.
The vertical sync is fed to pin 10 of buffer stage Q562c via pin 3 of P504,the output of the buffer is fed to V SYNC POLARITY DETECTION circuit to get the positive vertical sync from pin 11 of Q562d.

When G+SYNC signal, COMPOSITE SYNC signal and SEPARATE SYNC signal are input from the computer simultaneously. To prevent undesirable changes in picture stability, a SYNC SWITCH S102 is introduced.

When G+SYNC signal and COMPOSITE SYNC are coming together,the SYNC SWITCH should set at "OFF" position.

When G+SYNC signal and SEPARATE SYNC are coming together,the SYNC SWITCH should set at "OFF" position.

At separate sync only, the SYNC SWITCH should set at "ON" position.

3.30 MICROPROCESSOR CONTROL CIRCUIT

(Refer to circuit diagram Fig-30A)

TMP47P400VN is a CMOS 4-bit microprocessor for display monitor which realizes auto-scan function. Providing a variety of functions such as auto-measurement function of H SYNC and V SYNC to match with different signals.
Without the SYNC signal input,the microprocessor will not output any instruction.

MEMORY
A electrically erasable CMOS EEPROM IC504 (80021) is introduced and connected as a 256 X 8 serial memory to store the H PHASE, H SIZE ,V SIZE ,V CENTER ,DPC control data.
Pins 2, 3, 4, 7, 1/6 of IC504 are connected to Pins 9, 10. 11, 12, 13 of IC501 respectively.

There are 50 MEMORY LOCATIONS for the user to store the control data. 25 of them are FACTORY SETTINGS and the other 25 are USER SETTINGS. The location of the memory is defined by the microprocessor.

The output of IC510 contains H PHASE, H SIZE, V POSITION, V SIZE, DPC control signals which are derived via D/A converter IC505 on Pins 15/14/13/12/11 respectively.

DC VOLTAGE OUTPUT
Each output (Pins 10 to 15) of IC505 is a dc voltage (0V to 12V) in 64 levels in accordance with 6-bit data, the output voltage is controlled by ANALOG UP/DOWN key which is mounted on control panel.

For the DPMS requirement, at step 3 & step 4, a high level (+12V) signal is derived from Pins 9 & 7 respectively, they are the output of the power saving control, the control signals are sent to the main power supply. (Please refer to item 3.6 Power Saving)

For wide range of horizontal scan frequency application, the auxiliary dc voltage H. F/V (H. frequency to voltage) is generated from Pin 10 of IC505 and fed to the horizontal oscillation circuit via Pin 2 of P502.

HORIZONTAL MODE CONTROL SIGNAL
The signals H1 to H8 on Pins 25 to 17 of IC501 are mode control signals, the state of the signal is in accordance with horizontal frequency.

These outputs are fed to main circuit via buffer IC506/IC507 and P504 to control the horizontal oscillation circuit,horizontal linearity circuit and CS capacitors.

H1 is high when H frequency is from 28.0KHz to 63.0KHz
H2 is high when H frequency is from 28.0KHz to 40.0KHz
H3 is high when H frequency is from 28.0KHz to 76.9KHz
H4 is high when H frequency is from 28.0KHz to 66.9KHz
H5 is high when H frequency is from 28.0KHz to 59.9KHz
H6 is high when H frequency is from 28.0KHz to 52.9KHz
H7 is high when H frequency is from 28.0KHz to 42.9KHz
H8 is high when H frequency is from 28.0KHz to 32.9KHz

Pin 27 is the V POLARITY DETECTION input for IC501. When the polarity of vertical sync is positive, this pin is "LOW".
Pin 26 is the H POLARITY DETECTION input for IC501. When the polarity of horizontal sync is positive, this pin is "LOW".

Pin 36 is the input of horizontal synchronous signal, whose polarity is positive, in order to get a constant width of horizontal sync pulse , MULTIVIBRATORS IC503 is introduced, horizontal sync is fed to 36 of IC501, the sync signal on Pin 8 of IC503 has the duty 4 us. it is decided by R504/C508.

The positive V sync is fed to Pin 37 of IC501 via Pin 7 of P508, the positive H sync is fed to Pin 36 of IC501 via Pin 4 of P508 and multivibrator IC503,

Pins 31/32 are CLOCK INPUT and CLOCK OUTPUT, a clock generating circuit is built into the processor, so if a resonator X501(4MHz) is connected to the clock I/O pins a 4MHz clock signal can be obtained.

Pin 42 is supply voltage pin, it is connected to +5V power supply.
Pin 21 is ground pin ,it connect to 0V power supply.

SYSTEM RESET

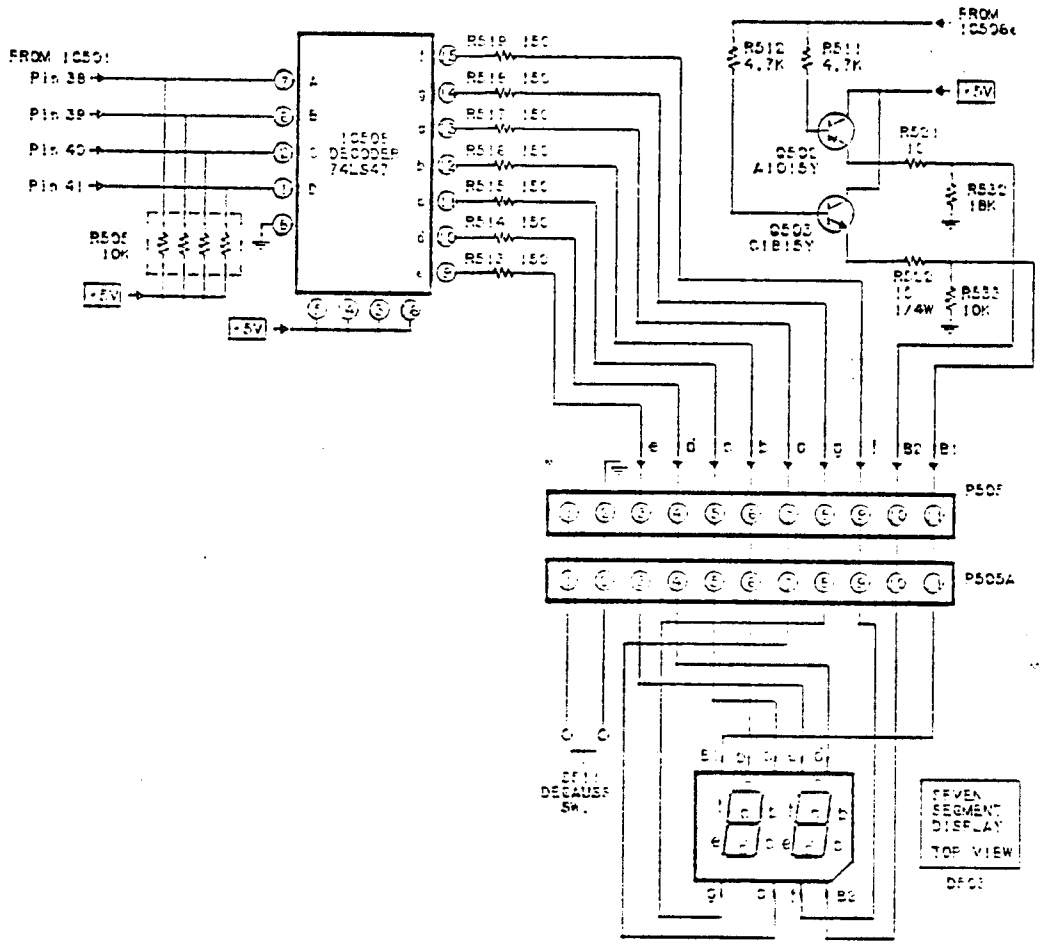
Pin 33 is RESET pin, it is connected to pin 3 of RESET IC IC502. Function of IC502 (Monolithic IC PST518A) is accurately resetting the system after detecting voltage at the time of switching power on and instance power off in the microprocessor circuit.

SEVEN SEGMENT DISPLAY

(Refer to circuit diagram Fig-30B)

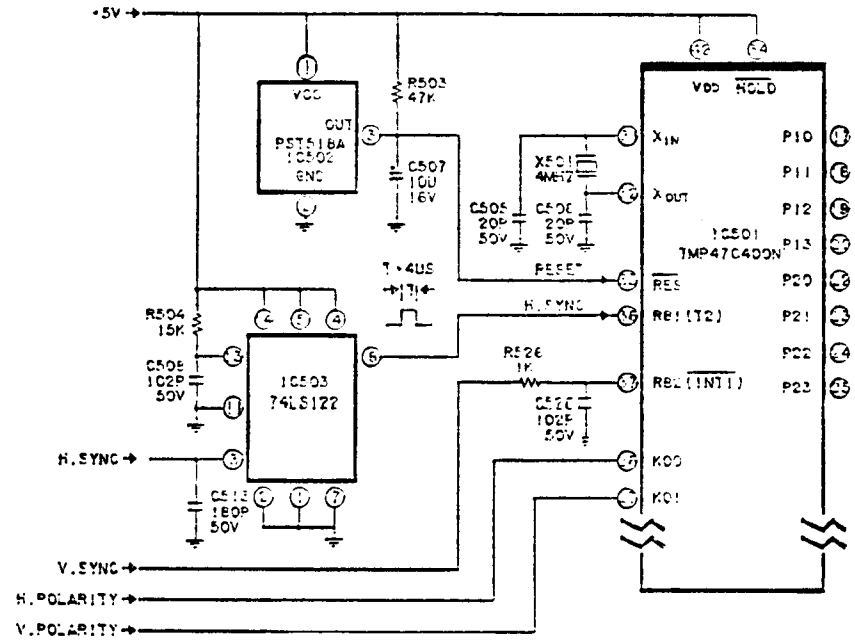
There are two seven-segment display adopted in the circuit, the display is derived by a single BCD-TO-SEVEN-SEGMENT decoder IC508 74LS47, in order to decrease the power consumption of the display , each seven-segment display is scan by the clock which is derived from Pin 16 of IC501, the clock is fed to the base of Q502 & Q503 via Pin 6 of IC506E.

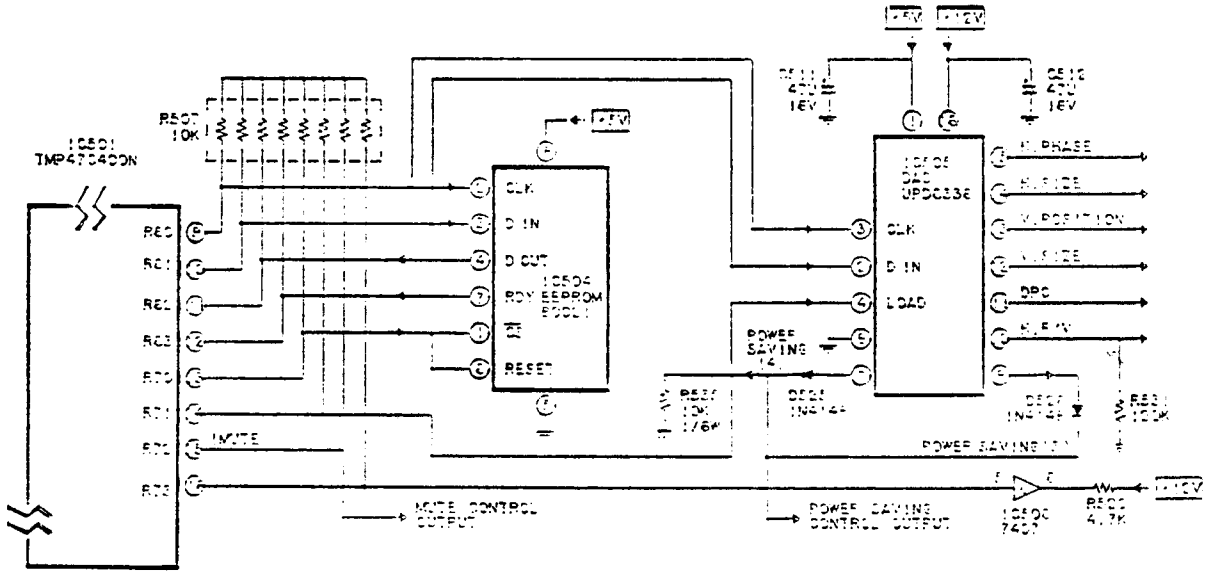
SEVEN SEGMENT DISPLAY CIRCUIT Fig-30B



MICROPROCESSOR CONTROL CIRCUIT

Fig-30A





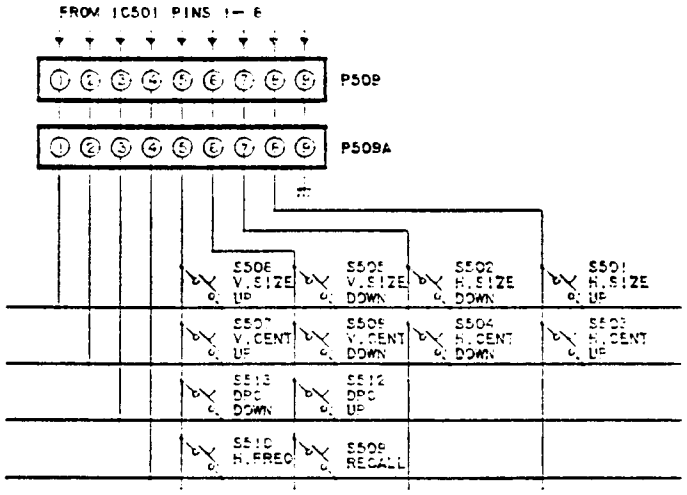
3.31

3.32 UP/DOWN CONTROL CIRCUIT

(Refer to circuit diagram Fig-32)

There are 6 pairs of UP/DOWN key mounted on control panel which is connected to the microprocessor Pins 1/2/3/4/5/6/7/8.
The user control is fed to the microprocessor via UP/DOWN key and P509. Pins 5/6/7/8 are key scan output, it output key-scan signal to external key matrix, Pins 1/2/3/4 are key return input. The key scan operation is performed when the signal state is active "low".

UP/DOWN CONTROL CIRCUIT Fig-32



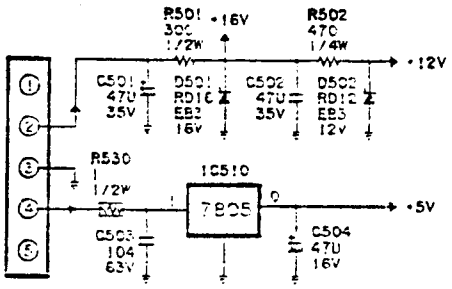
3.33 VOLTAGE SUPPLY

(Refer to circuit diagram Fig-33)

The voltage supply of the micro board has its own regulator which differ from the regulator of the main board .

The +16V/+12V/+5V supply lines to the microprocessor circuit are fed via the network D501/D502/IC510 and some discrete components.

MICRO BOARD POWER SUPPLY CIRCUIT Fig-33



3.34 VIDEO PREAMPLIFIER

(Refer to circuit diagram Fig-34)

The video amplifier consists of preamplifier M52307SP, output stage and cutoff adjustment circuit.

PREAMPLIFIER
There is a three channel video preamplifier I001 being used to generate the video signal.

The RED channel preamplifier for example:

The input video signal (0.7V peak) is buffered by emitter follower Q001; The output of which is AC coupled (C005) to pin 2 of the preamplifier I001.

The positive clamp signal is fed to pin 14 of I001 to restore the DC-level at the preamplifier output (pin 8). Only the pedestal electric potential undergoes sampling by the pin 14 clamp pulse.

Pin 15 is the DC-level input for the clamp circuit. The DC-level is restored via external capacitor (Hold capacitor) C008.
Therefore as a result of this, the pedestal electric potential on pin 28 is held, according to the pin 9 electric potential.

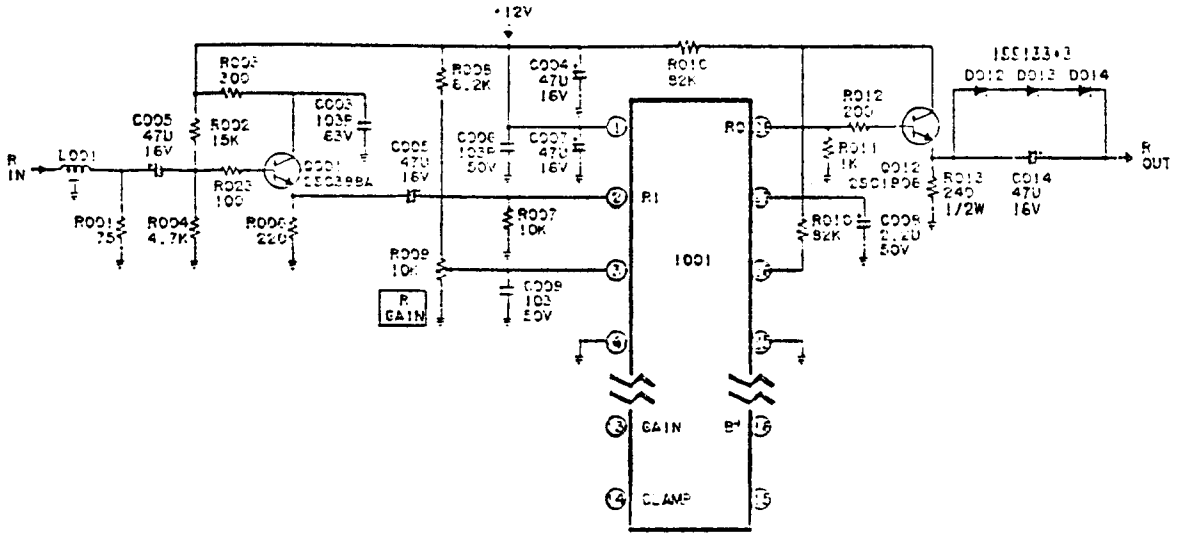
The video signal which is output from pin 28 is amplified and turned around by the attached circuit and having been attenuated by the resistor divider R011/R012.

The signal voltage on pin 28 is typically 3.5V peak at maximum channel gain. It is fed to the output stage (Q015/Q016) via buffer Q012.

C014 is AC coupling capacitor.D012/D013/D014 are dc-bias diodes .

Pin 13 is the gain control of the preamplifier I001.
The supply voltage on Pins 1/5/9 are +12V.

RED VIDEO PREAMPLIFIER CIRCUIT Fig-34



3.35 VIDEO OUTPUT STAGE

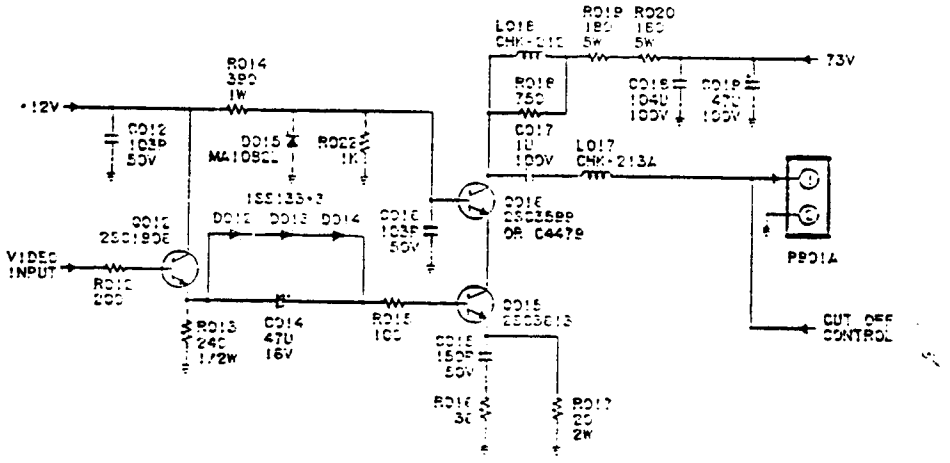
(Refer to circuit diagram Fig-35)

The output signal to the cathode is provided by cascade amplifier Q015/Q016. The gain of this stage is approximates to 16. L017 and L018 are peaking coils for high frequency video response. C015 and R016 are emitter peakings.
Though a circuit is complicated, it is possible to choose kinds of CRT to set arbitrary DC voltage, thus C017 is used to make the output circuit be a AC coupling system.

The cathode is DC clamped by network D183/D184/Q181/C178/R185 R124/R181/R180. The DC clamping or CUTOFF level at the cathode is set by potentiometer R189 (R160/R159 for green, R129 for blue), the B+ of the potentiometer is provided by +12V.

Network Q182/R182/R183/R188/R189, along with Green and Blue channel equivalents, enable the color point of the monitor to optimized during set up.
The CUTOFF potentiometers R189/R129 enable the background of the monitor to be adjusted
during set up.

OUTPUT STAGE CIRCUIT Fig-35



3.36 BRIGHTNESS CONTROL

(Refer to circuit diagram Fig-36)

The brightness control is achieved by varying the CUTOFF voltage of the CRT.
The reference voltage is derived from Pin 4 of P503A via voltage divider R560/R561/R562, the reference voltage is buffered by Q140 and fed to R,G,B CUTOFF circuit via R183/R153/R123 respectively.

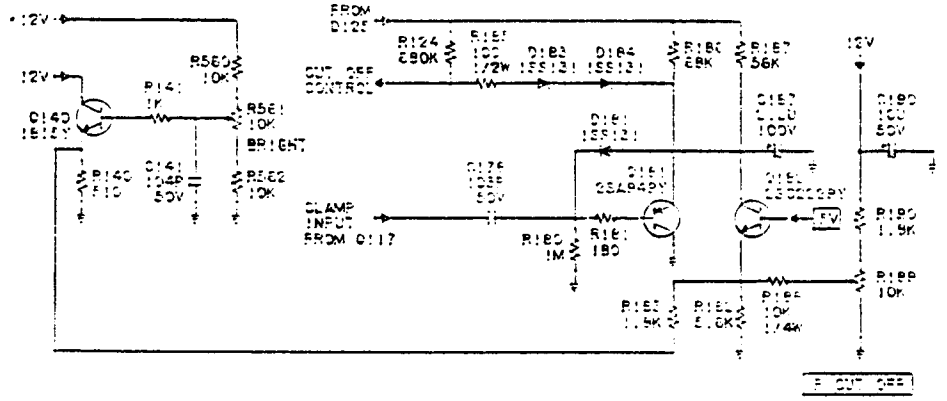
RED CUTOFF circuit for instance:

The CUTOFF voltage is controlled by Q181/Q182, the higher voltage on the emitter of Q182 the higher voltage on the base of Q181, also the higher voltage (CUTOFF voltage) on the emitter of Q181.

The brightness control potentiometer R561 is mounted on the control panel. The control signal is fed to the base of Q140 via Pin 4 of P503A.
Thus if have any voltage change on pin 4 of P008,the brightness of the CRT will be changed.

The transistor Q181/Q182 modulates the black level of the video signal with the clamp signal.
The level (CUTOFF) of modulation is set by the ratio of R183/R182 R188 and the user brightness control.

BRIGHTNESS CONTROL /RED CUT OFF CIRCUIT Fig-36



3.37 CONTRAST CONTROL

(Refer to circuit diagram Fig-37)

The contrast control is achieved by varying the video amplitude of the output signal.

RED channel for instance:
The video amplitude of the preamplifier I001 is controlled by the voltage of pin 13. The higher dc voltage on Pin 13 gives the bigger amplitude on video output (Pin 28).

The contrast control circuit is implemented by Q133/Q134 and Q131. Q131 & Q134 are ABL control stages, Q133 is the buffer stage for contrast control signal.

The control signal is fed to the base of Q133 via Pin 2 of P503A via and resistor divider R563/R564/R565.

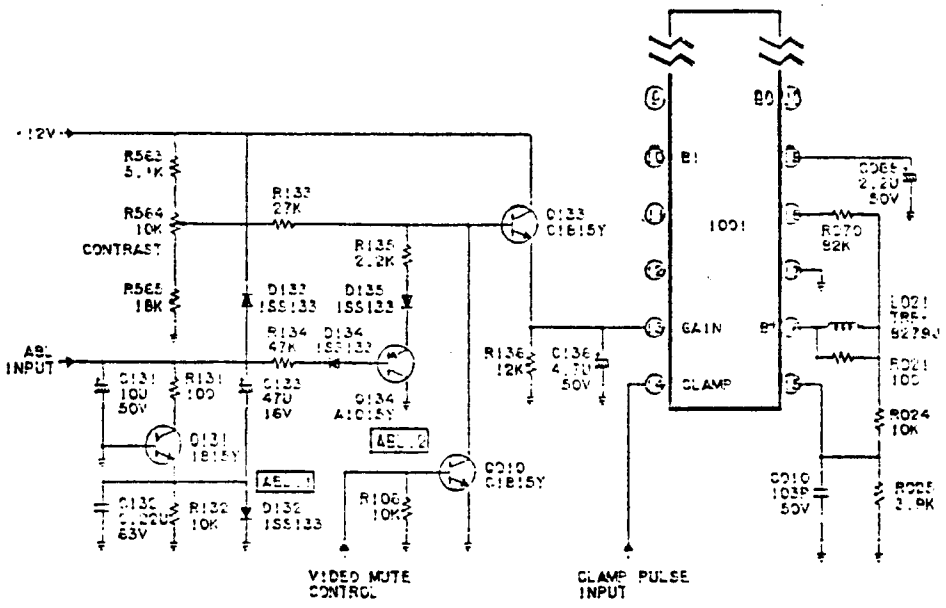
The higher voltage on the base of Q133 gives the higher dc voltage on Pin 13 of I001, naturally gives the bigger amplitude for the output and more colorful picture on the screen.

Potentiometer R009/R039 and R069 are the GAIN control for the preamplifier I001, also enable the color point of the monitor optimized during set up.

VIDEO MUTE

The collector of video mute transistor Q010 is connected to the base of Q133, the mute signal is fed to the base of Q010. When Q010 is on, Q133 will be off, so the voltage on Pin 13 (GAIN CONTROL) is 0V, it means no video signal will be generated.

CONTRAST CONTROL Fig-37



3.38 ABL (AUTOMATIC BRIGHTNESS LIMIT) CIRCUIT

(Refer to circuit diagram Fig-38)

The ABL circuit in fact is a voltage feedback circuit which varies the gain of all three video channels simultaneously. The negative feedback signal is proportional to the anode current of the CRT.

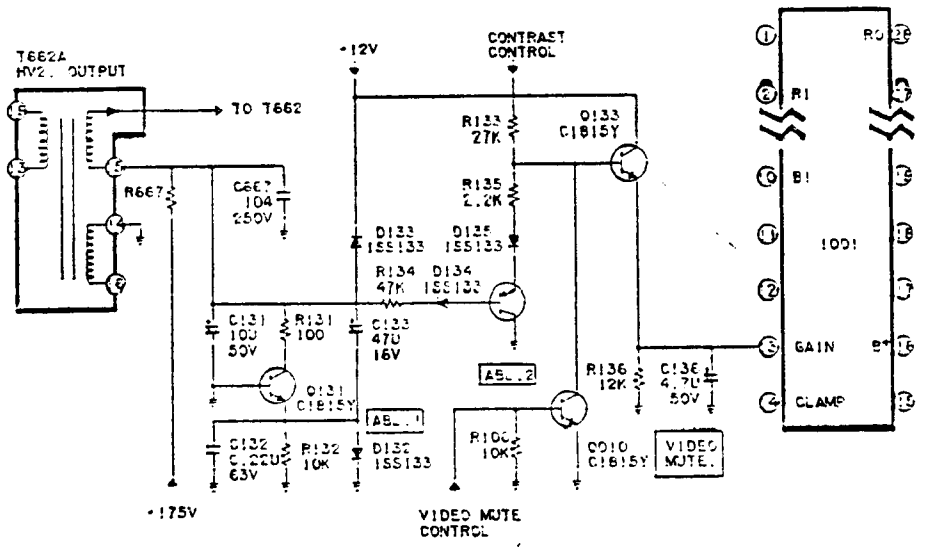
The voltage on Pin 15 of T662A is the voltage drop of +75V via R667. The component value is selected so as to limit the maximum current of the CRT. (400uA approximately)

The signal is fed to the base of ABL control stage Q134 via pin 1 of P602A. The higher voltage on Pin 1, means the darker of the picture, the lower voltage on Pin 1, means the brighter of the picture. So via Q134, this signal will control video gain and limit the CRT current automatically.

The ABL signal is also fed to the collector of Q131 and C133 to get stable ABL function.

ABL CIRCUIT

Fig-38



3.39 CLAMP SIGNAL

(Refer to circuit diagram Fig-39)

The CLAMP signal for the video amplifier and background circuit is generated by sync processor I101.

Pin 17 is the clamp signal output of I101, video clamp signal is fed to pin 14 of video amplifier I001.

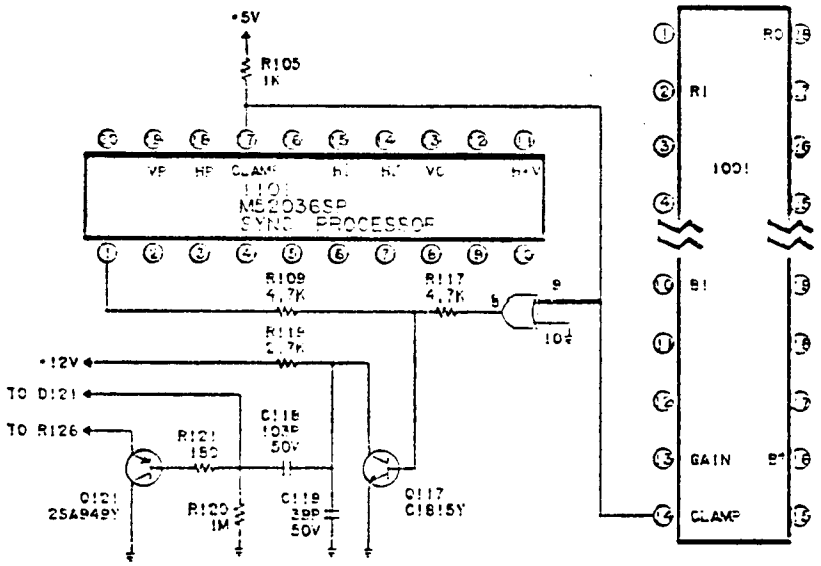
Pin 1 of I101 is the output of Sync mode detection. When G+SYNC signal input, this pin is "LOW". When COMPOSITE or SEPARATE signal input, this pin is "HIGH". This output signal is fed to the base of the cut off control gate Q117.

Only at the G+SYNC signal input mode, the clamp signal is fed to CUT OFF circuit Q121/Q151/Q181 via I102d and Q117.

The clamp pulse width is determines by R116 and C116. as the value are made larger, the clamp pulse width becomes wider.

CLAMP SIGNAL CIRCUIT

Fig-39

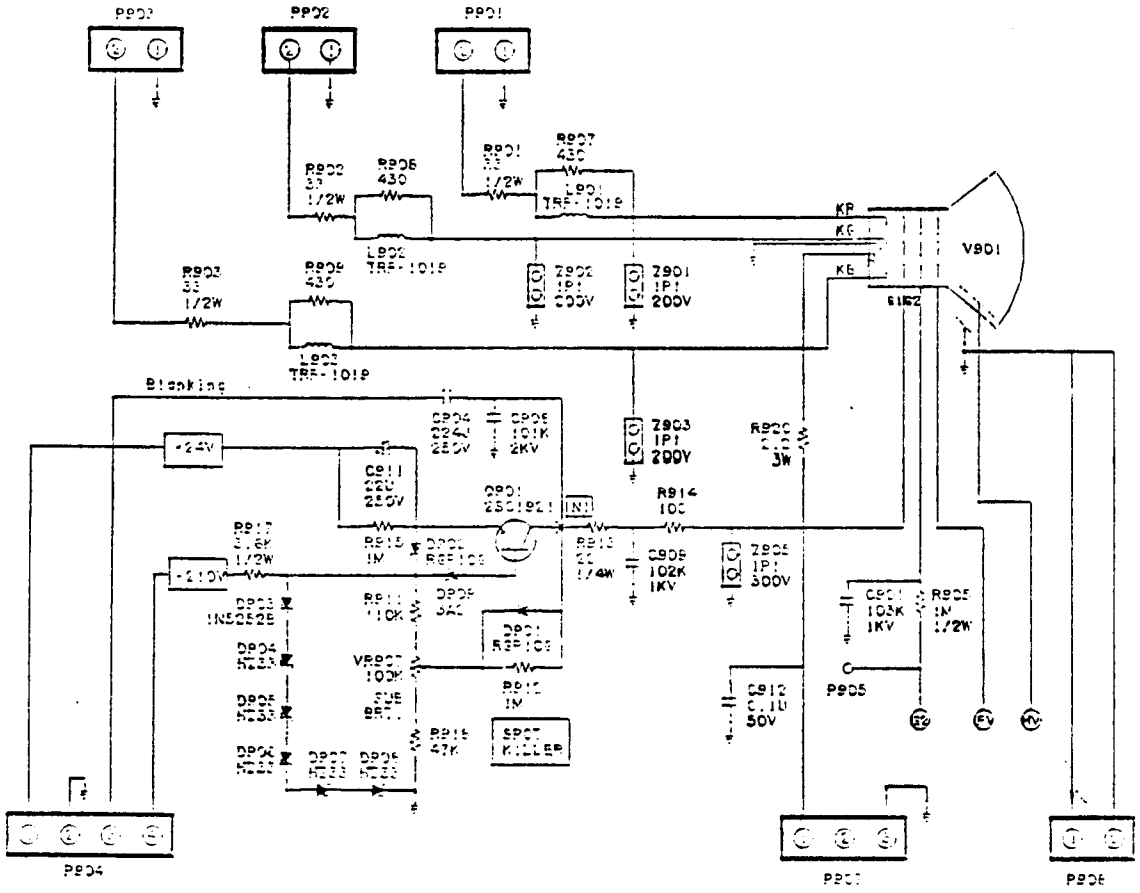


3.40 CRT DRIVE CIRCUIT

(Refer to circuit diagram Fig-40)

The output of the RED video signal is fed to the CRT (KR) via Pin 2 of P901. R907 and L904 are output peakings.
Z901 is Spark gap whose spark voltage is 200V is used for preventing high voltage discharge from the CRT to the video amplifier, it may cause the damage during the CRT discharge.
R901 is surge absorbing resistor, it prevent short-circuiting of video amplifier's output in low impedance condition with decrease of surge voltage after the spark gap works.

CRT DRIVE CIRCUIT/SPOT KILLER CIRCUIT Fig-40



3.41 SPOT KILLER CIRCUIT

(Refer to circuit diagram Fig-40)

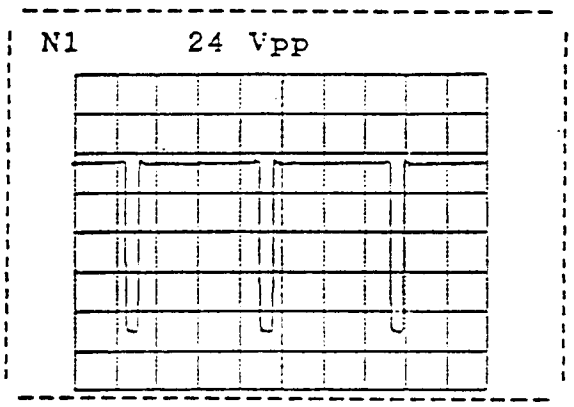
The spot killer circuit is introduced, In order to eliminate the SPOT damage on the screen of the CRT while power is on or off. The circuit supplied of -189V is provided by the zener diode chain D903 to D908.
When power is on, both +24V and -189V will charge C911 via D902. Totally will have -213V voltage charge on C911. At this moment Q901 is off.

When power is off, the positive end of C911 is grounded, Q901 is on, -213v will fed to G1 of CRT via Q901 to achieve the SPOT KILLER purpose.

Potentiometer R907 is used as SUB. BRIGHT for the monitor.
The BLANKING signal is fed to G1 via Pin 3 of P904 and C904.
The HEATER VOLTAGE +6V is fed to the CRT via Pins 1 & 3 of P907.

The HIGH VOLTAGE (+26KV) is fed to the anode of the CRT.
The DYNAMIC FOCUS VOLTAGE is also fed to the CRT via the dynamic focus circuit.

TEST CONDITION	TEST POINT	TEST POINT NAME
Fh=31KHz	N1	BLANKING VOLTAGE



3.42 DYNAMIC FOCUS CIRCUIT

In order to get the optimum focus, the focus voltage must be changed for each beam landing position, This is called dynamic focus.
The optimum focus voltage waveform is parabolic both horizontally as well as vertically. Dynamic focus is normally achieved by shaping, processing and amplifying the waveform of both deflection currents.

FOCUS
Focus 1 should be adjusted so that the vertical lines become narrowest in all over the screen.
Focus 2 should be adjusted so that the horizontal lines become narrowest in all over the screen.

Network Q705/Q706 is cascade amplifier, C709/R733 is used to apply an AC voltage to the focus electrode.

There are two kinds of dynamic focus circuit for the monitor

Circuit 1 (PWB-1795)

(Refer to circuit diagram Fig-42A)

The horizontal parabola signal is fed to the buffer Q704 via Pin 2 of P710 and network C704/R708/C701/R707, the signal is amplified by Q706 and Q705, the output signal is derived from the emitter of Q705.

The vertical parabola signal is fed to the base of the buffer Q707 via Pin 2 of P703 and network R725/C725, the signal is amplified by Q708, the output signal is derived from the collector of Q708, both the horizontal and vertical parabola signal are fed the CRT via C709 and R733.

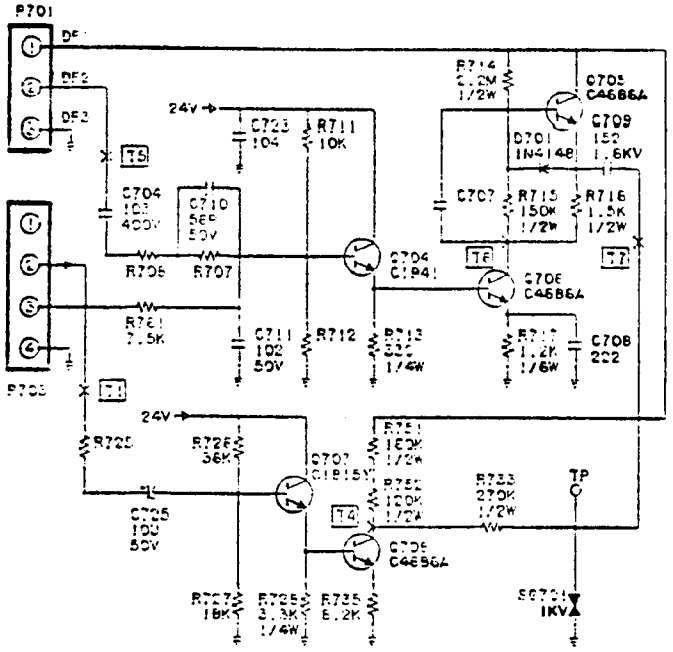
Circuit 2 (PWB-2001)

(Refer to circuit diagram Fig-42B)

The horizontal parabola signal is fed to Pin 1 of the amplifier I702 M51392 via network R701/C702. Then, the output of the signal (Pin 8 of I702) is fed to Pin 2 of the high speed operational amplifier I701A to get the enough signal amplitude, the output stage is composed of Q701/Q702/Q706. The amplitude of the output signal is auto-controlled by I701B, in order to get a constant output signal level for different input frequency. R721 is the gain control.

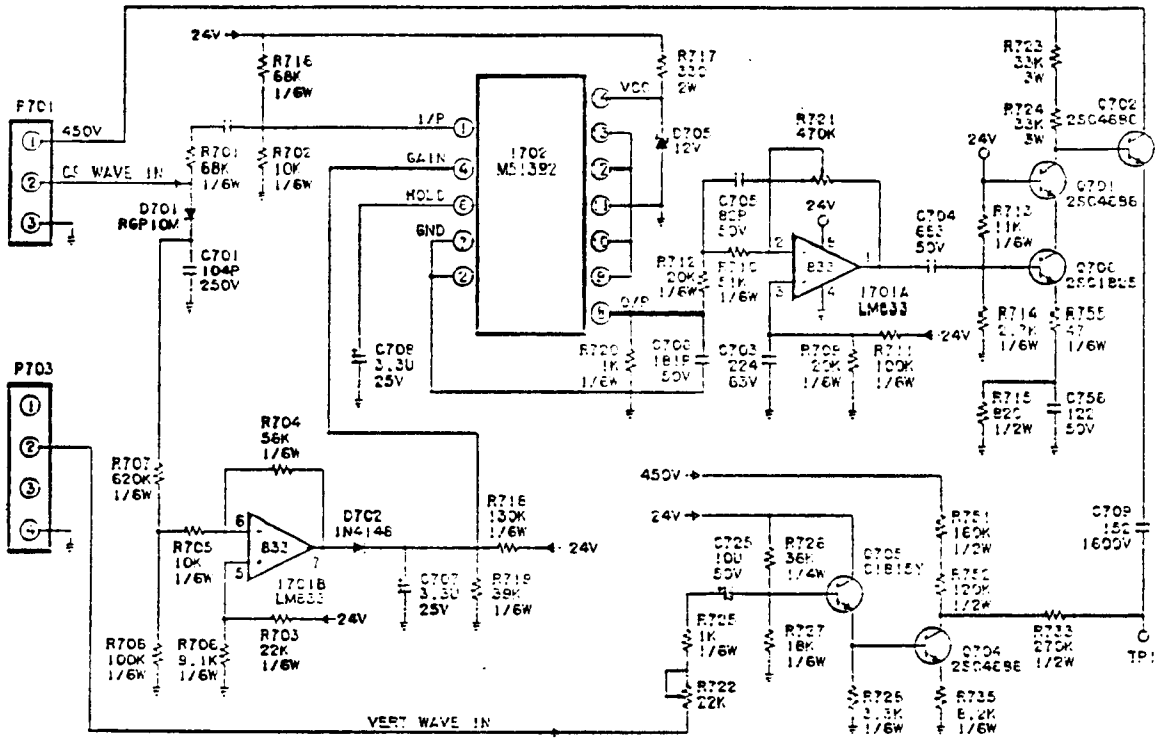
The vertical parabola signal is fed to the base of the buffer Q705 via Pin 2 of P703 and network R725/R722/C725, the signal is amplified by Q704, the output signal is derived from the collector of Q708, both the horizontal and vertical parabola signal are fed the CRT via C709 and R733. The horizontal and vertical parabola signal are summing at TP1.

DYNAMIC FOCUS CIRCUIT 1 Fig-42A



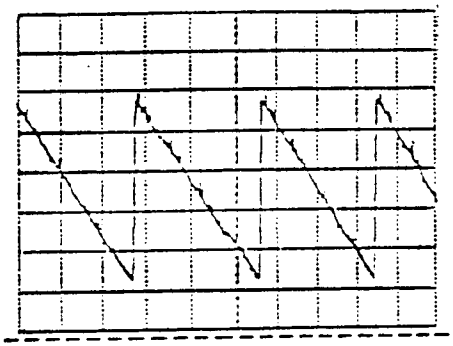
DYNAMIC FOCUS CIRCUIT 2

Fig-42B

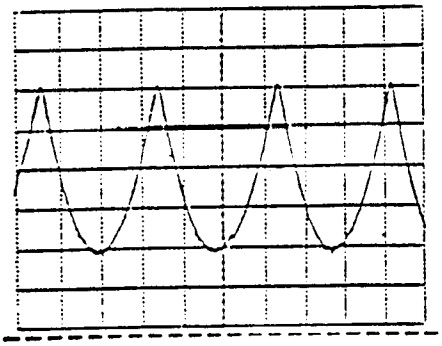


TEST CONDITION	TEST POINT	TEST POINT NAME
Fh=31KHz	T1	V SAWTOOTH SIGNAL INPUT
	T2	V PARABOLA SIGNAL INPUT
	T3	BASE SIGNAL
	T4	V PARABOLA SIGNAL OUTPUT

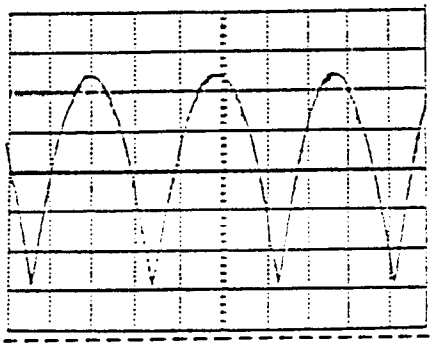
T1 2.5 Vpp



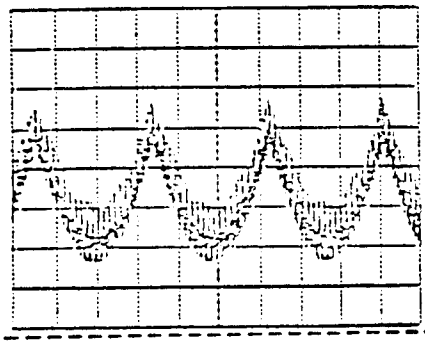
T2 8.2 Vpp



T3 5.2 Vpp

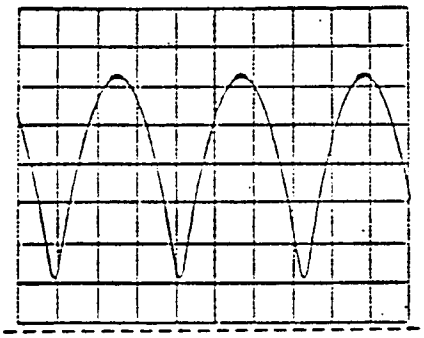


T4 200 Vpp

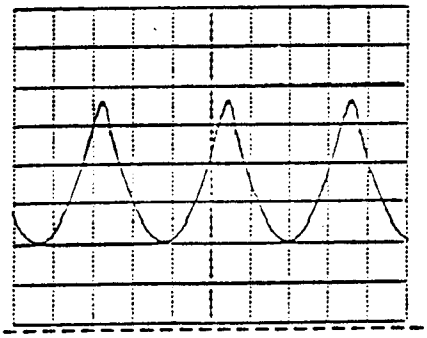


TEST CONDITION	TEST POINT	TEST POINT NAME
Fh=31KHz	T5	H PARABOLA SIGNAL INPUT
	T6	COLLECTOR SIGNAL
	T7	H PARABOLA SIGNAL OUTPUT

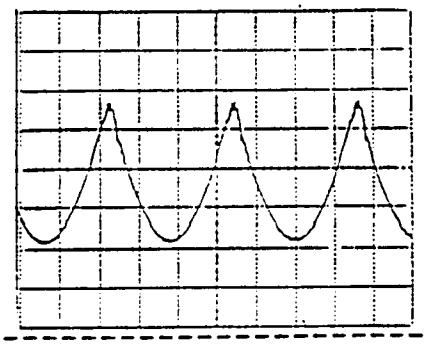
T5 27 Vpp



T6 180 Vpp



T7 180 Vpp



TROUBLE SHOOTING

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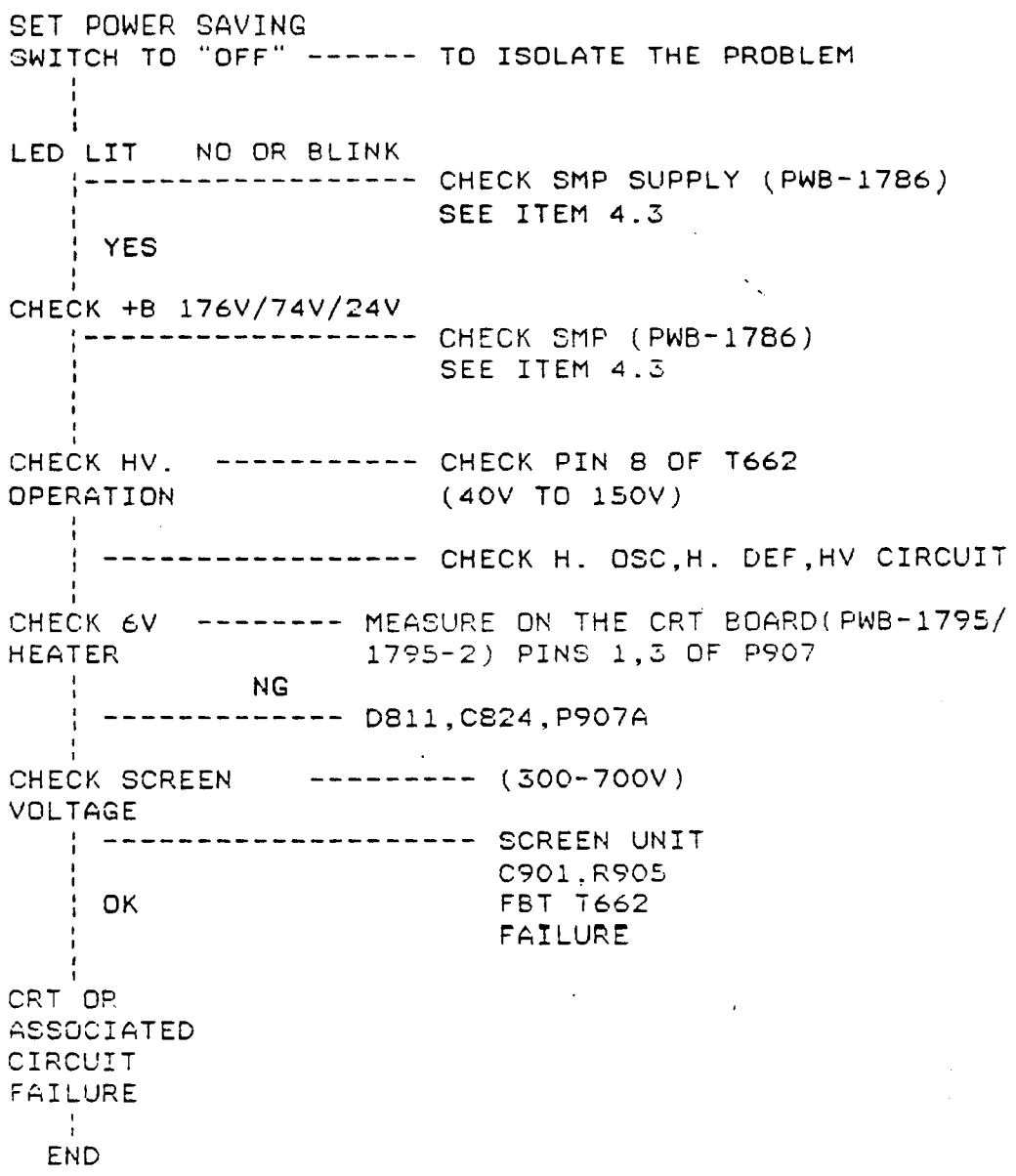
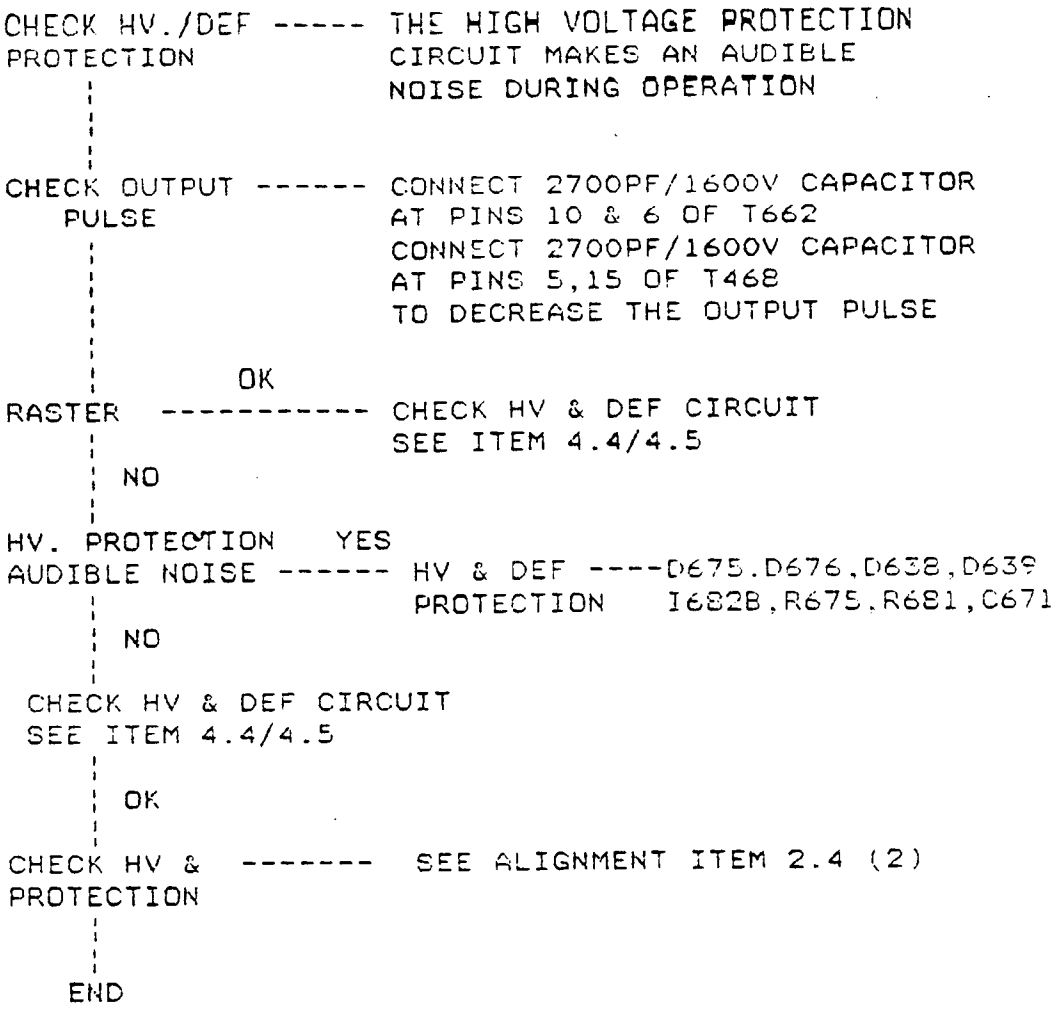
4.1 NO RASTER


SET POWER SAVING
SWITCH TO "OFF" ------ TO ISOLATE THE PROBLEM
LED LIT NO OR BLINK
CHECK SMP SUPPLY (PWB-1786)
SEE ITEM 4.3
YES
CHECK +B 176V/74V/24V
CHECK SMP (PWB-1786)
SEE ITEM 4.3
CHECK HV. OPERATION
CHECK PIN 8 OF T662
(40V TO 150V)
CHECK H. OSC,H. DEF,HV CIRCUIT
CHECK 6V HEATER
MEASURE ON THE CRT BOARD(PWB-1795/
1795-2) PINS 1,3 OF P907
NG
D811,C824,P907A
CHECK SCREEN VOLTAGE
(300-700V)
SCREEN UNIT
C901,R905
FBT T662
FAILURE
OK
CRT OR ASSOCIATED CIRCUIT FAILURE
END

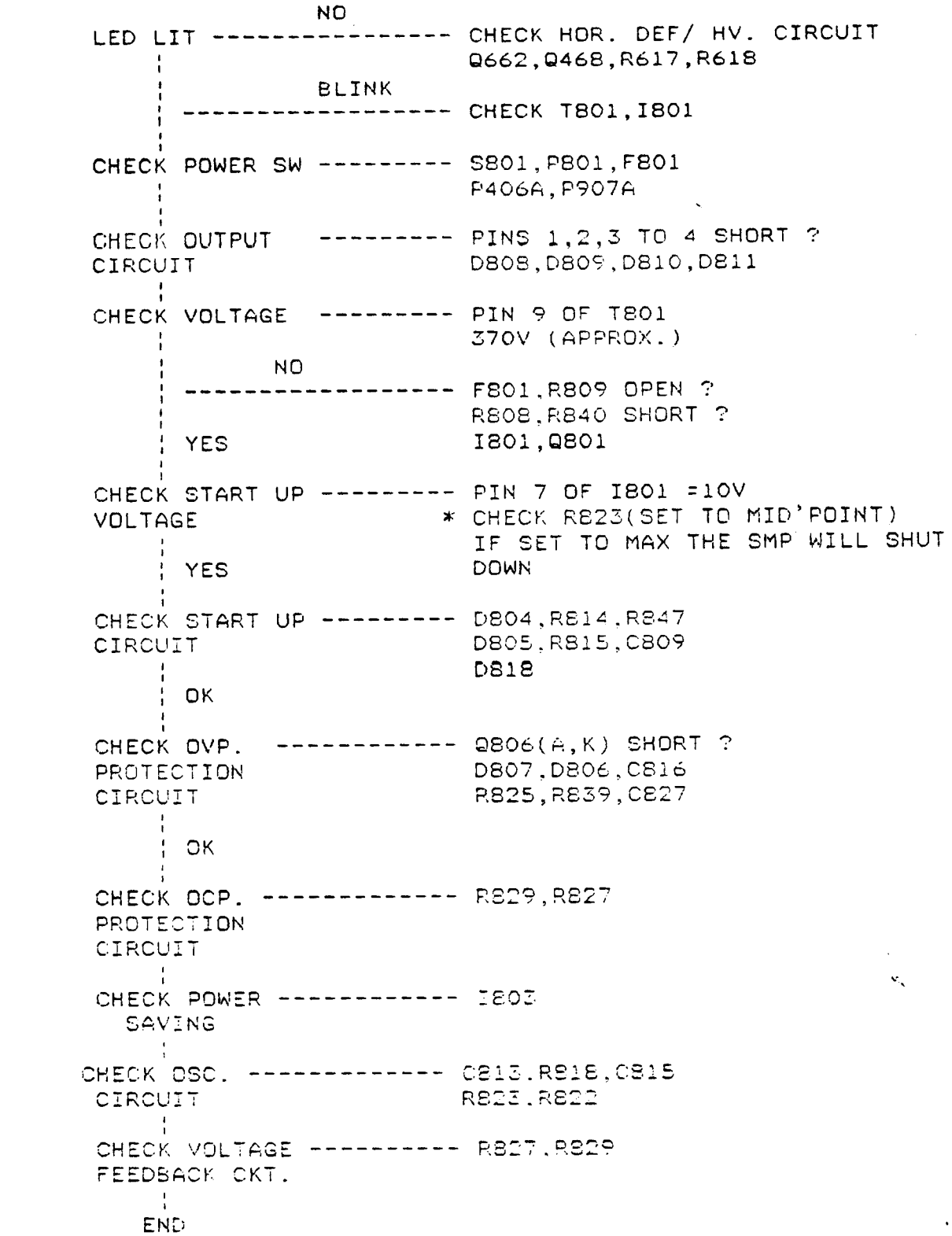
4.2 NO RASTER (HV./DEF PROTECTION CIRCUIT FAILURE)

* SET THE HORIZONTAL INPUT FREQUENCY AT 82KHz

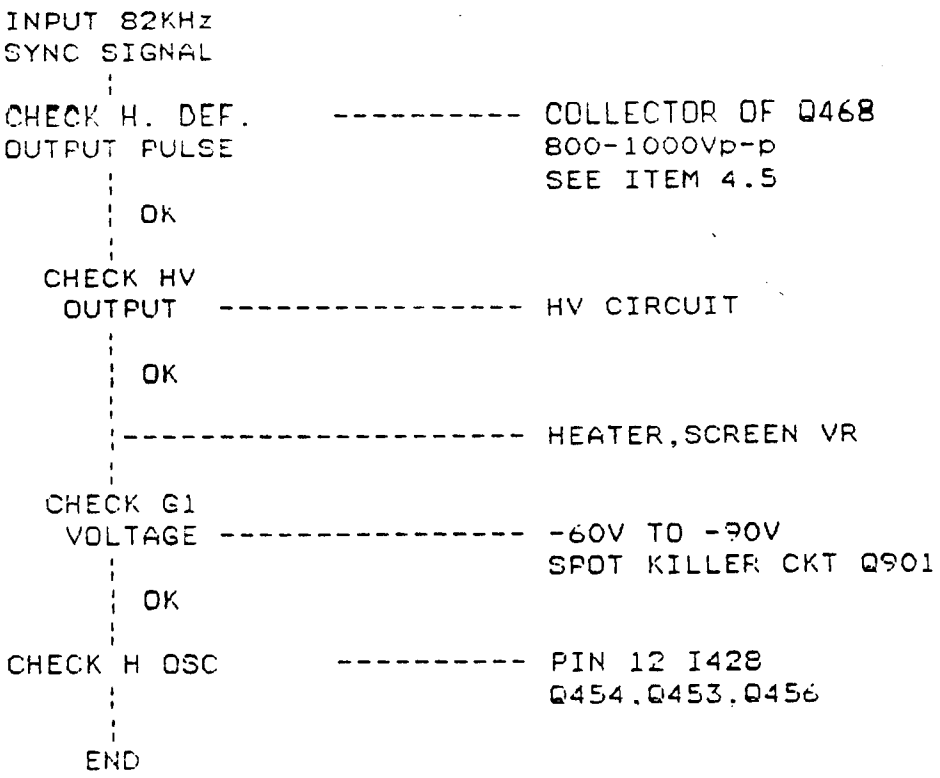

CHECK HV./DEF PROTECTION
THE HIGH VOLTAGE PROTECTION CIRCUIT MAKES AN AUDIBLE NOISE DURING OPERATION
CHECK OUTPUT PULSE
CONNECT 2700PF/1600V CAPACITOR AT PINS 10 & 6 OF T662
CONNECT 2700PF/1600V CAPACITOR AT PINS 5,15 OF T468
TO DECREASE THE OUTPUT PULSE
OK
RASTER
CHECK HV & DEF CIRCUIT SEE ITEM 4.4/4.5
NO
HV. PROTECTION AUDIBLE NOISE
YES
HV & DEF PROTECTION
D675,D676,D638,D639 I682B,R675,R681,C671
NO
CHECK HV & DEF CIRCUIT SEE ITEM 4.4/4.5
OK
CHECK HV & PROTECTION
SEE ALIGNMENT ITEM 2.4 (2)
END

4.3 POWER START NG (SMP PWB-1641 FAILURE)

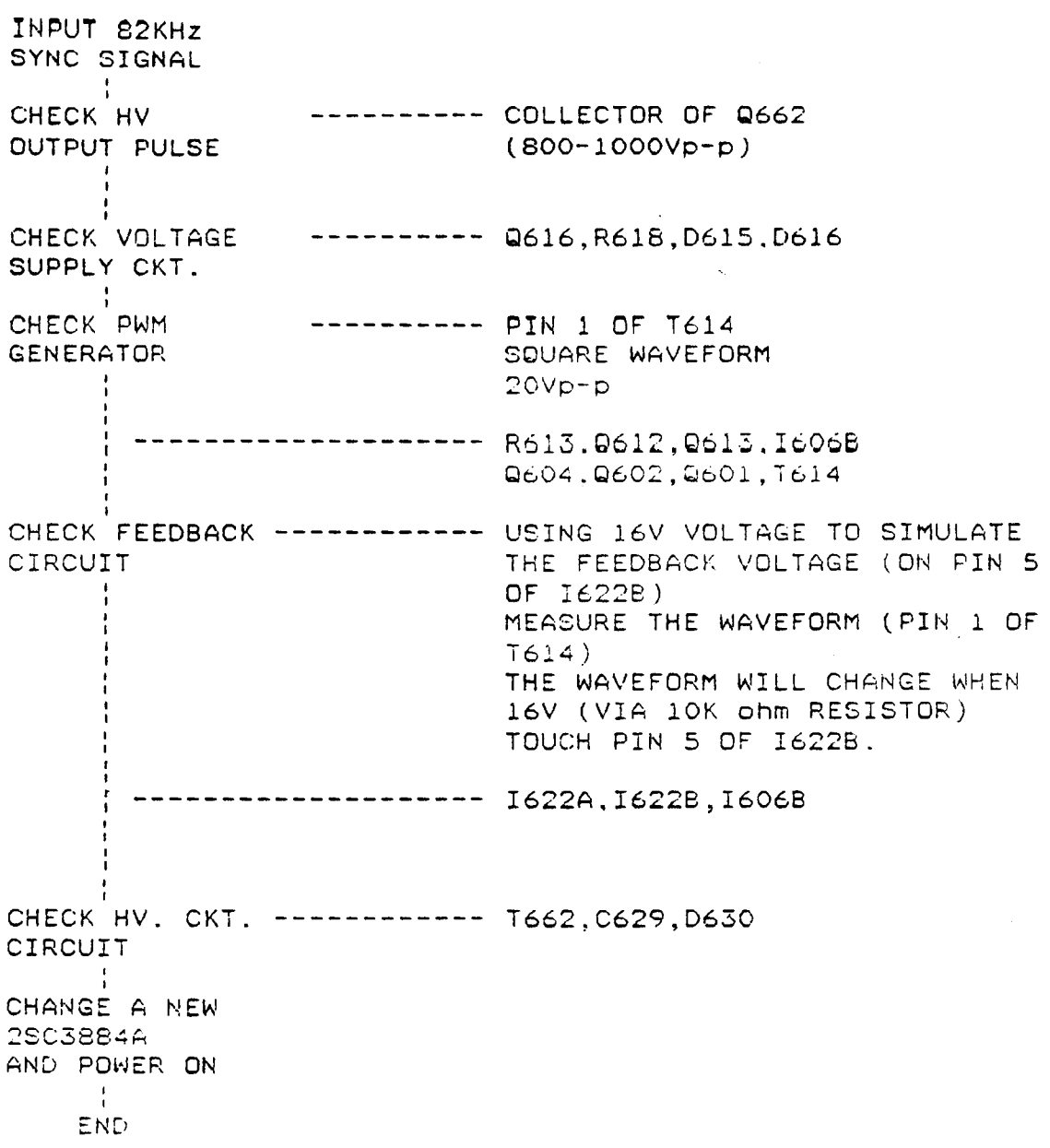
SET THE POWER SAVING FUNCTION "OFF", BY S102 (REAR COVER)



4.4 NO RASTER (H. OSC FAILURE)



4.5 NO RASTER (HV. CKT. FAILURE)



4.6 SPECIAL CONDITION

1. Q468 (2SC4897) DEFECT WHEN POWER ON
2. Q468 (2SC4897) DEFECT DURING 30 MINUTES WARM UP
3. Q662 (2SC3884A) DEFECT WHEN POWER ON
4. Q662 (2SC3884A) DEFECT DURING 30 MINUTES WARM UP

POSSIBLE SITUATION

SURGE VOLTAGE
The transistor defect when power on. The problem usually come from the SURGE VOLTAGE on the collector, the SURGE VOLTAGE which is much higher than the transistor rating. It break through the transistor junction among collector, base and emitter.

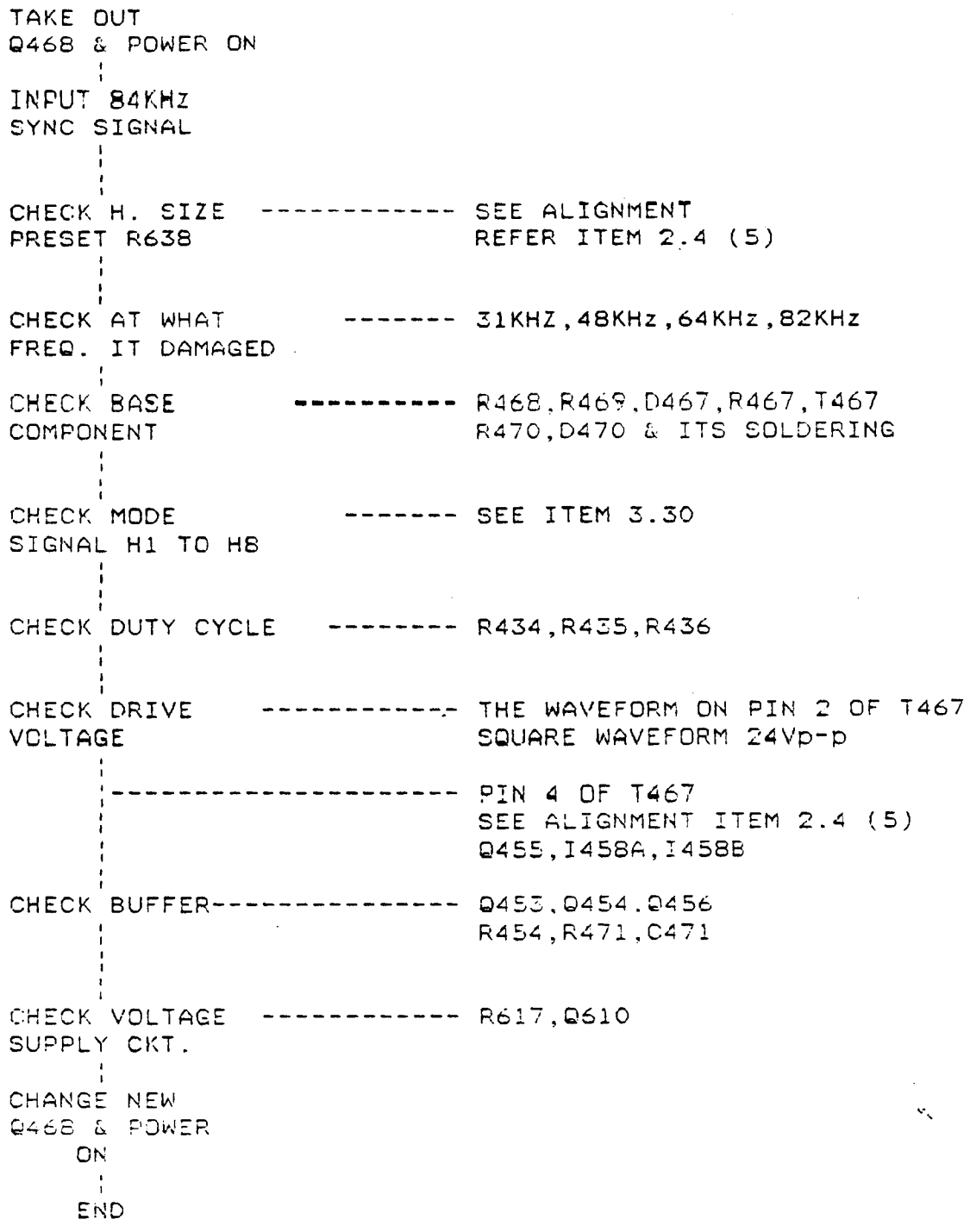
DRIVE CURRENT
The transistor defect during warm up. The problem usually come from the lack of enough DRIVE CURRENT on the base, the lack of enough DRIVE CURRENT, caused the increasing of the impedance (collector to emitter) of the transistor.
Finally the THERMO-RUN-AWAY happened inside the transistor.

Both of the situation will damage the transistor causing the short circuit between collector, base or emitter.

4.7 Q468 (2SC4897) DAMAGED DUE TO THE SURGE VOLTAGE

TAKE OUT Q468
FROM MAIN BOARD
& POWER ON
|
INPUT 82KHz
SYNC SIGNAL
|
CHECK VOLTAGE ---------- Q610,R617,D609.D608
SUPPLY CKT.
|
CHECK PWM ---------- PIN 1 OF T608
GENERATOR SQUARE WAVEFORM
20Vp-p
| NO
| ---------- R607,Q607,Q608.I606A
| Q601,Q605,Q603.D602,D603
| YES Q602
|
CHECK FEEDBACK ---------- USING 16V VOLTAGE TO SIMULATE
CIRCUIT THE FEEDBACK VOLTAGE (ON PIN 3
OF I638A)
MEASURE THE WAVEFORM (PIN 1 OF
T608)
THE WAVEFORM WILL CHANGE WHEN
16V (VIA 10K ohm RESISTOR)
TOUCH PIN 3 OF I638A.
| NO
| ---------- I638A,I638B,R638,D637,C638
|
| YES
|
CHECK HOR. DEF ---------- H. DY,L486,L487.C468,C469
CIRCUIT D483,D469,R473.D484,R484
|
CHANGE A NEW
2SC4897
AND POWER ON
|
END

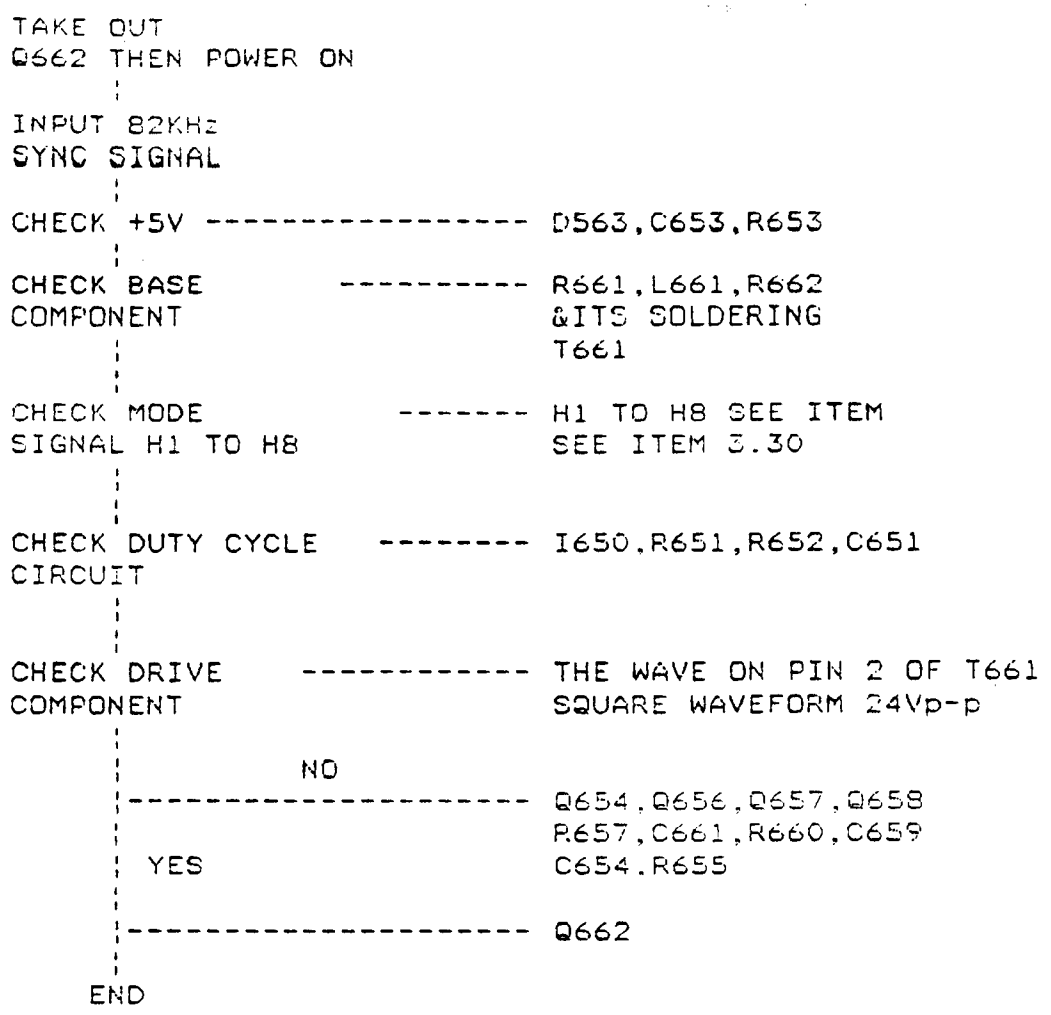
4.8 Q468 (2SC4897) DAMAGED DUE TO THE DRIVE CURRENT


TAKE OUT Q468 & POWER ON
INPUT 84KHz SYNC SIGNAL
CHECK H. SIZE PRESET R638
SEE ALIGNMENT REFER ITEM 2.4 (5)
CHECK AT WHAT FREQ. IT DAMAGED
31KHZ,48KHz,64KHz,82KHz
CHECK BASE COMPONENT
R468,R469,D467,R467,T467 R470,D470 & ITS SOLDERING
CHECK MODE SIGNAL H1 TO H8
SEE ITEM 3.30
CHECK DUTY CYCLE
R434,R435,R436
CHECK DRIVE VOLTAGE
THE WAVEFORM ON PIN 2 OF T467 SQUARE WAVEFORM 24Vp-p
PIN 4 OF T467 SEE ALIGNMENT ITEM 2.4 (5)
Q455,I458A,I458B
CHECK BUFFER
Q453,Q454,Q456 R454,R471,C471
CHECK VOLTAGE SUPPLY CKT.
R617,Q610
CHANGE NEW Q468 & POWER ON
END

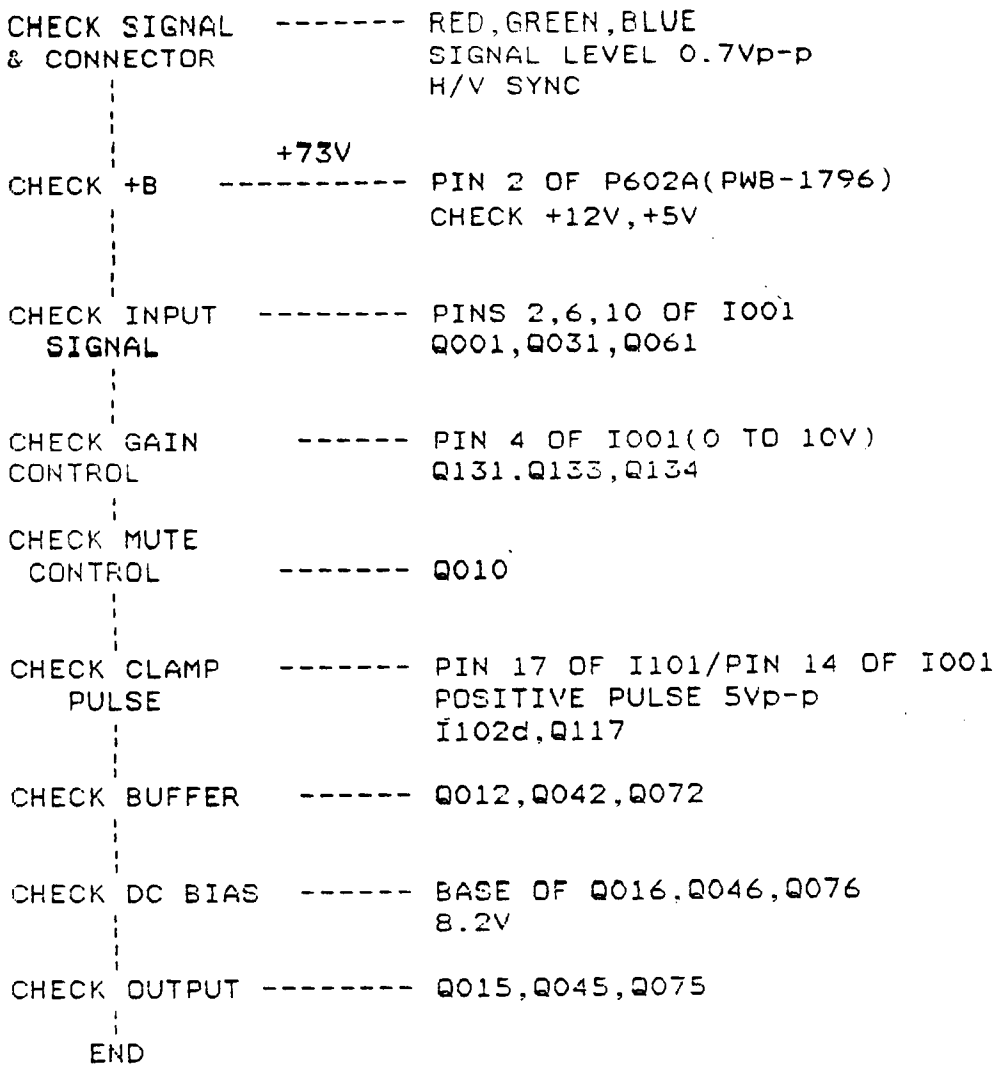
4.9 Q662 (2SC3884A) DAMAGED DUE TO THE SURGE VOLTAGE

TAKE OUT Q662
FROM MAIN BOARD
& POWER ON
|
INPUT 82KHz
SYNC SIGNAL
|
CHECK HV1 ADJ. ------ ADJUST R675 & R685
HV2 ADJ. FULLY COUNTERCLOCKWISE
|
CHECK
|
CHECK VOLTAGE ---------- Q612,R667,D609,D610
SUPPLY CKT.
|
CHECK PWM ---------- PIN 2 OF T601
GENERATOR SQUARE WAVEFORM
20Vp-p
|
---------- R607,Q609,Q610.Q606b
Q602,Q601.D600,Q604,Q605
D605,C603,D602,D603
|
CHECK FEEDBACK ---------- USING 16V VOLTAGE TO SIMULATE
CIRCUIT THE FEEDBACK VOLTAGE (ON PIN 5
OF I622B)
MEASURE THE WAVEFORM (PIN 2 OF
T601)
THE WAVEFORM WILL CHANGE WHEN
16V (VIA 10K ohm RESISTOR)
TOUCH PIN 5 OF I622B.
|
---------- Q613a,Q130b,R616.D604
R621.R622.C620,C629
|
CHECK HV. OUTPUT ---------- T603,L607.C625,D615
CIRCUIT
|
CHANGE A NEW ------- READJUST HIGH VOLTAGE
2SC3884A SEE ALIGNMENT 2.4 (2)
AND POWER ON
|
END

4.10 Q662 (2SC3884A) DAMAGED DUE TO THE DRIVE CURRENT


TAKE OUT
Q662 THEN POWER ON
INPUT 82KHz
SYNC SIGNAL
CHECK +5V ---------- D563,C653,R653
CHECK BASE COMPONENT ---------- R661,L661,R662 &ITS SOLDERING T661
CHECK MODE SIGNAL H1 TO H8 ------- H1 TO H8 SEE ITEM SEE ITEM 3.30
CHECK DUTY CYCLE CIRCUIT -------- I650,R651,R652,C651
CHECK DRIVE COMPONENT ---------- THE WAVE ON PIN 2 OF T661 SQUARE WAVEFORM 24Vp-p
NO
---------- Q654,Q656,Q657,Q658 R657,C661,R660,C659
YES C654,R655
---------- Q662
END

4.11 NO VIDEO

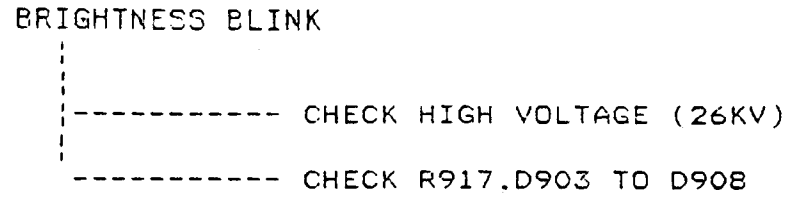

CHECK SIGNAL & CONNECTOR
RED,GREEN,BLUE
SIGNAL LEVEL 0.7Vp-p
H/V SYNC
+73V
CHECK +B
PIN 2 OF P602A(PWB-1796)
CHECK +12V,+5V
CHECK INPUT SIGNAL
PINS 2,6,10 OF I001
Q001,Q031,Q061
CHECK GAIN CONTROL
PIN 4 OF I001(0 TO 10V)
Q131.Q133,Q134
CHECK MUTE CONTROL
Q010
CHECK CLAMP PULSE
PIN 17 OF I101/PIN 14 OF I001
POSITIVE PULSE 5Vp-p
I102d,Q117
CHECK BUFFER
Q012,Q042,Q072
CHECK DC BIAS
BASE OF Q016,Q046,Q076
8.2V
CHECK OUTPUT
Q015,Q045,Q075
END

4.12 ABNORMAL VIDEO ON CRT SCREEN

A. TOO BRIGHT OR TO DARK

```
CHECK R.G.B    --- MEASURE ON THE VIDEO PCB
VIDEO OUTPUT       PWB-1795
      |            PIN 2 OF P901,P902,P903
      |
      |
CHECK 6V       ---- PIN 1 OF P907
      |             R920(PWB-1795/1795-2)
      |      NG
      |  ---------- D811,C824,P907A(PWB-1786)
      |  OK
      |
CHECK G1   ------- G1 OF PWB-1643
VOLTAGE            (-50V TO -100V)
      |
      |      NG
      |  ---------- Q901,VR907,D903 TO D908
      |             (PWB-1795/1795-2)
      |  OK         R666,D666,C666(PWB-1785)
      |
CHECK VIDEO AMP ------ PWB-1796
      |                SEE ITEM 4.9
      |
CHECK 12V ------- LOW OR OV. SEE ITEM 4.28
      73V         CONNECTOR P602A
      |           FAILURE
      |  OK
      |
CHECK SCREEN ---- TOO LOW
VOLTAGE           SCREEN UNIT C901,R905
      |           T662 FAILURE
      |
      |
      |  ---------- 300-700V, CRT FAILURE
      |
    END
```

B. PICTURE'S BRIGHTNESS BLINK

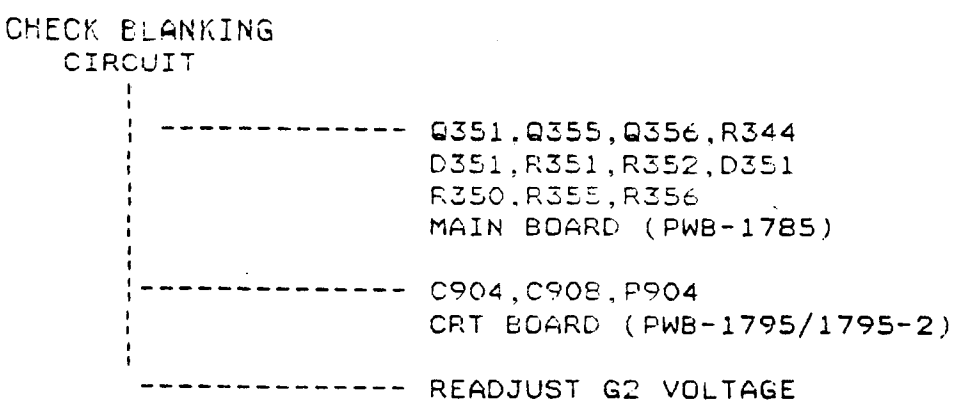


4.13 ABNORMAL WHITE BALANCE & TRACKING

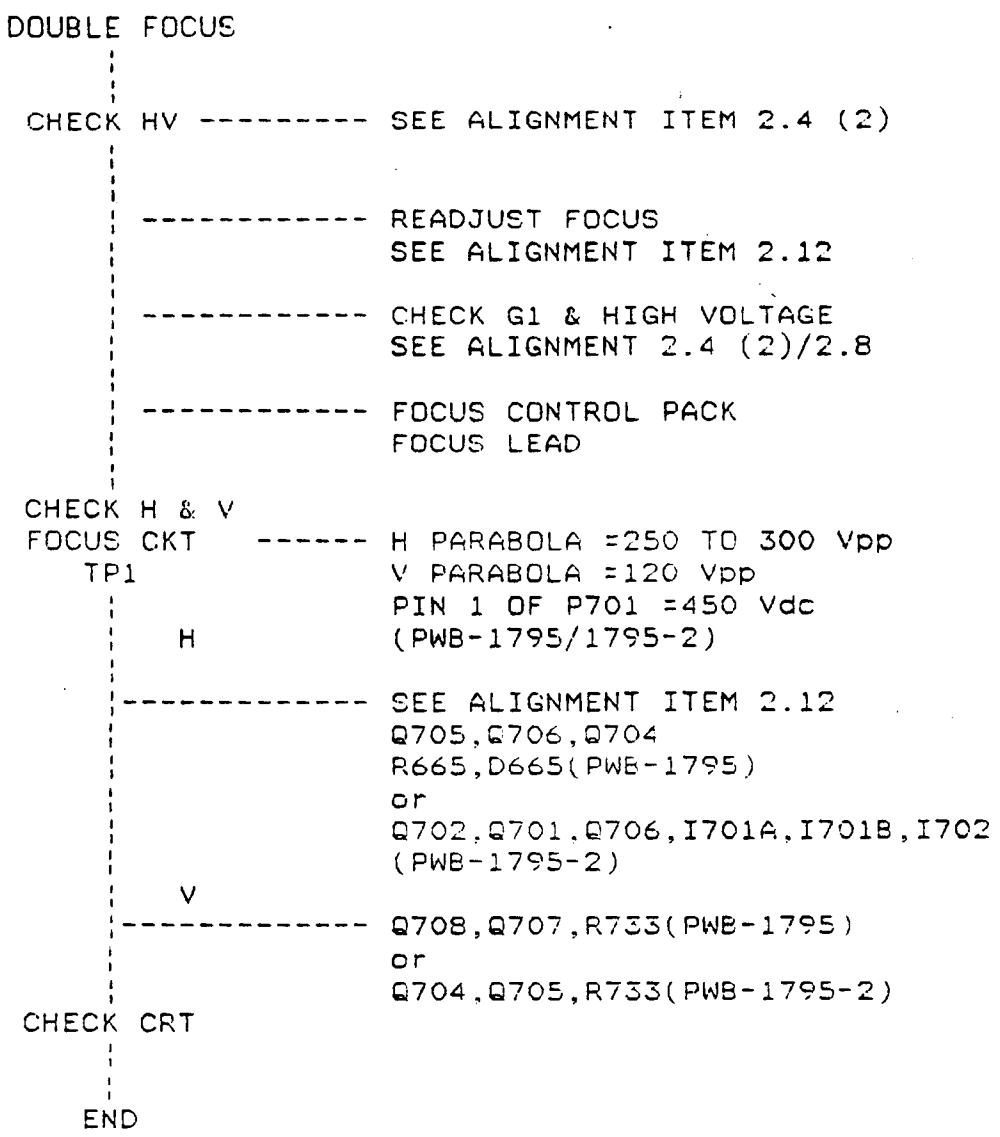
->ABNORMAL BRIGHTNESS CONTROL	------	Q181,Q182 (PWB-1796) Q151,Q152 Q121,Q122 Q140,Q117
->ABNORMAL CUT OFF CONTROL	------	R129,R189 (PWB-1796) D121,D151,D181 C118,C148,C178
->READJUST WHITE BALANCE	-----	REFER TO THE ALIGNMENT ITEM 2.8

4.14 NO VIDEO BLANKING

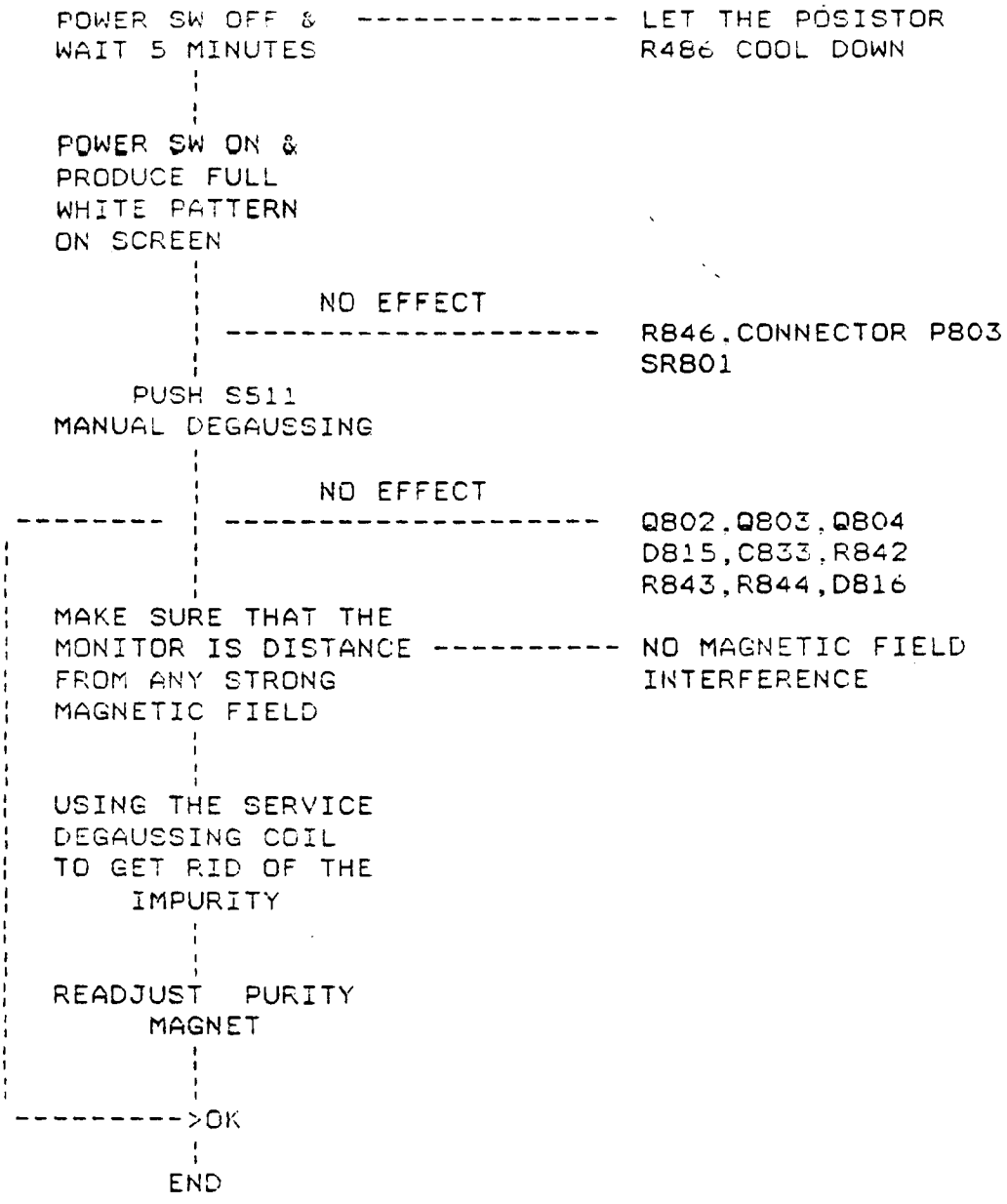
ie: VISIBLE RETRACE LINE ON THE BACKGROUND RASTER



4.15 POOR FOCUS

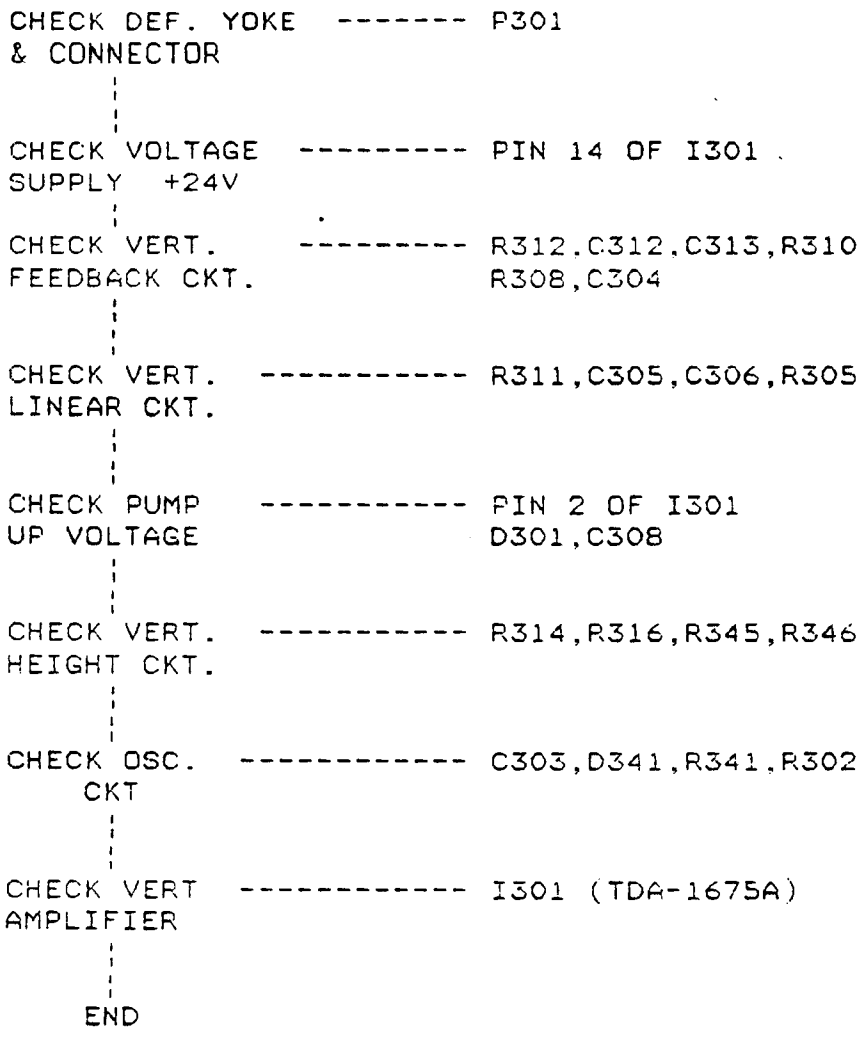


4.16 IMPURITY



4.17 NO VERTICAL DEFLECTION

A BRIGHT HORIZONTAL LINE ON THE SCREEN

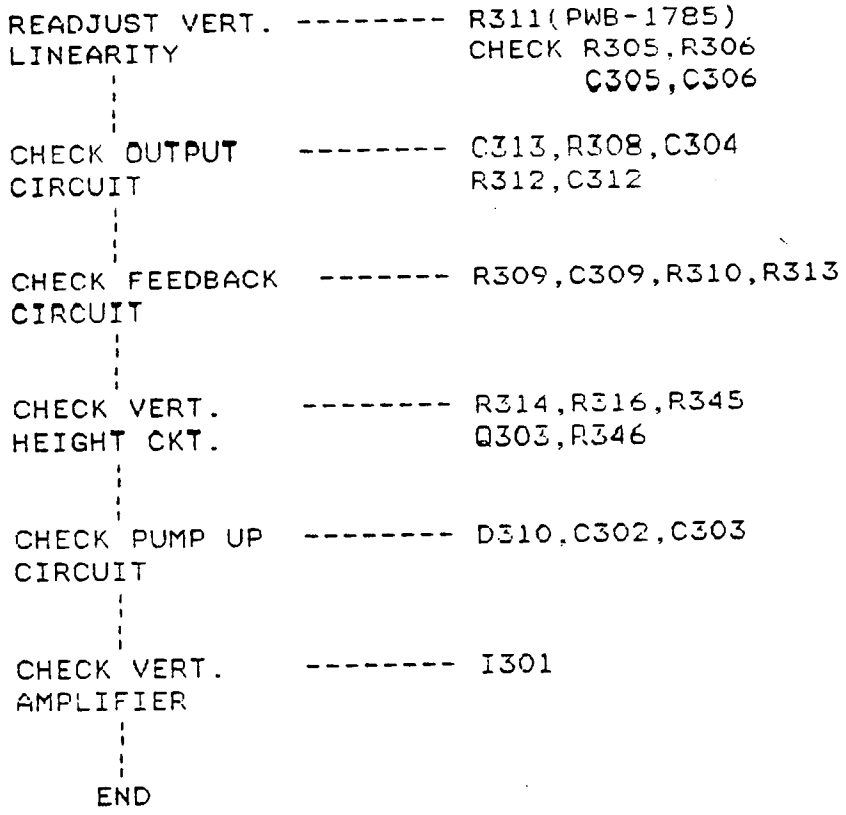


4.18 ABNORMAL VERTICAL HEIGHT

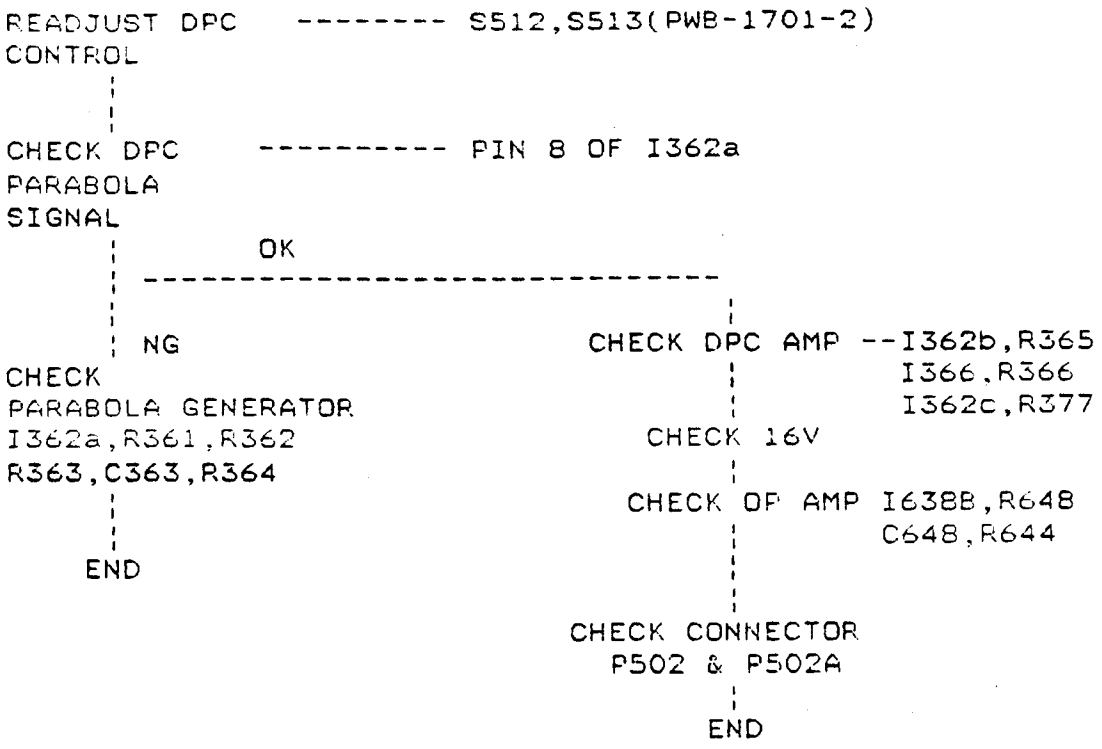
```
CHECK +24V SUPPLY                MEASURE PIN 3 P406A
    |                            ON PWB-1786
    |  TOO LOW
    |----------------------      SEE SMP ITEM 4.3
    |
    |  OK
    |        TOO LOW
CHECK 16V  ----------------      R201,I201,R203,R205
    |                            C206(PWB-1785)
    |
    |  ------  VERTICAL SIZE     Q303,C319,R346
    |          CIRCUIT           R314,R345
    |
    |  ------  VERTICAL OSC      D302,C303,R302
    |                            R341
    |
    |  ------  DEF. CIRCUIT      R312,C312,C313,D301
    |                            R308,C308,DY
    |
    |  -------  READJUST         V. HEIGHT
                                 SEE ALIGNMENT 2.4 (6)
```

```
V. MODE                  FAILURE CONDITION:
    |                    TOO SMALL AT PARTICULAR MODE
    |
    |  --------------    CHECK SYNC SIGNAL INPUT
    |                    VIDEO BOARD(PWB-1796)
    |                    H+V,H/V,G+SYNC
    |
    |  --------------    CHECK MICROPROCESSOR IC501
                         MODE DETECTION CIRCUIT
                         PINS 26,27
```

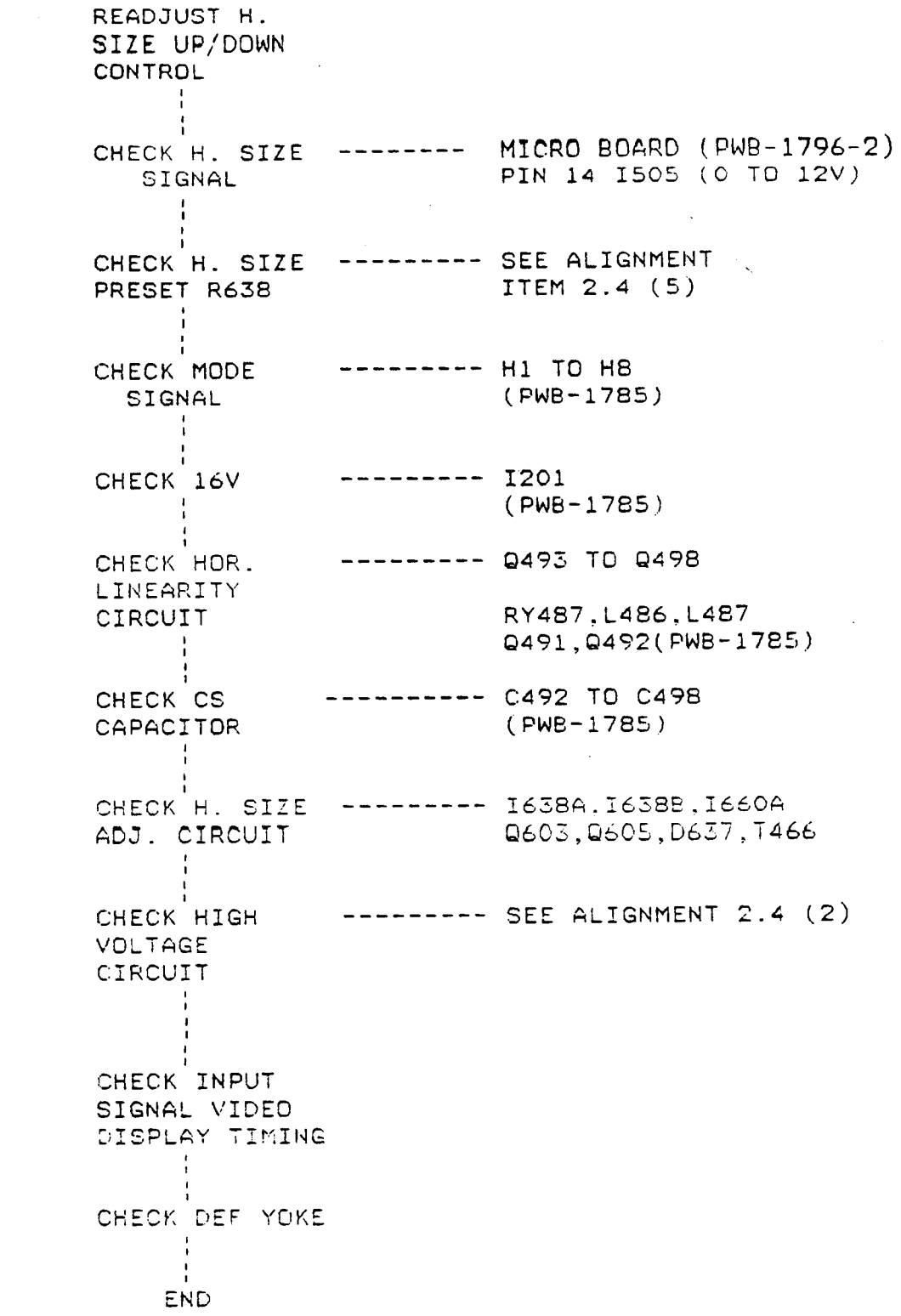
4.19 ABNORMAL VERTICAL LINEARITY



4.20 DPC NOT WORK

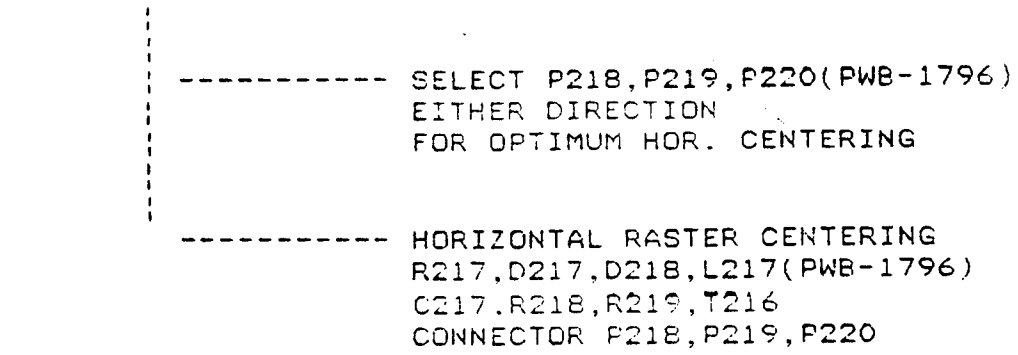


4.21 ABNORMAL HORIZONTAL WIDTH



4.22 CENTERING

HORIZONTAL RASTER CENTERING



4.23 PICTURE CENTERING (HOR. PHASE)

HOR. CENTERING CIRCUIT

---------- HOR. CENTERING CIRCUIT
I440A,Q449,I401C,I401D
R439,R440,R441,R442,D402
D403,R448,R449,C450,R450
R428,C428(PWB-1785)
S503/S504(PWB-1797/1798)

---------- MICROPROCESSOR H. PHASE
IC505 (Pin 15/Vdc=0 to 15V)
P502(PWB-1796-2)

---------- CHECK F/V CIRCUIT
I420C,I420D(PWB-1785)

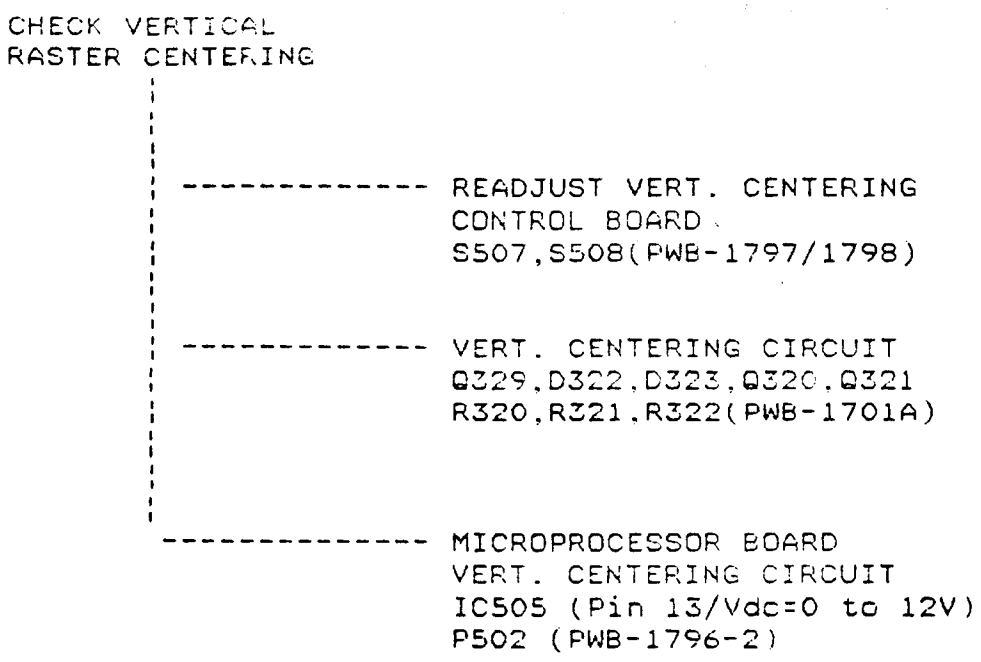
---------- CHECK HOR. SYNC CIRCUIT (PWB-1785)
Q443,R443,R447,R426,R427
R429,C426,C429

---------- CHECK HOR. AFC CIRCUIT (PWB-1785)
C431,R430,R431
C430,C433

---------- READJUST HOR. CENTERING
SEE ALIGNMENT ITEM 2.3

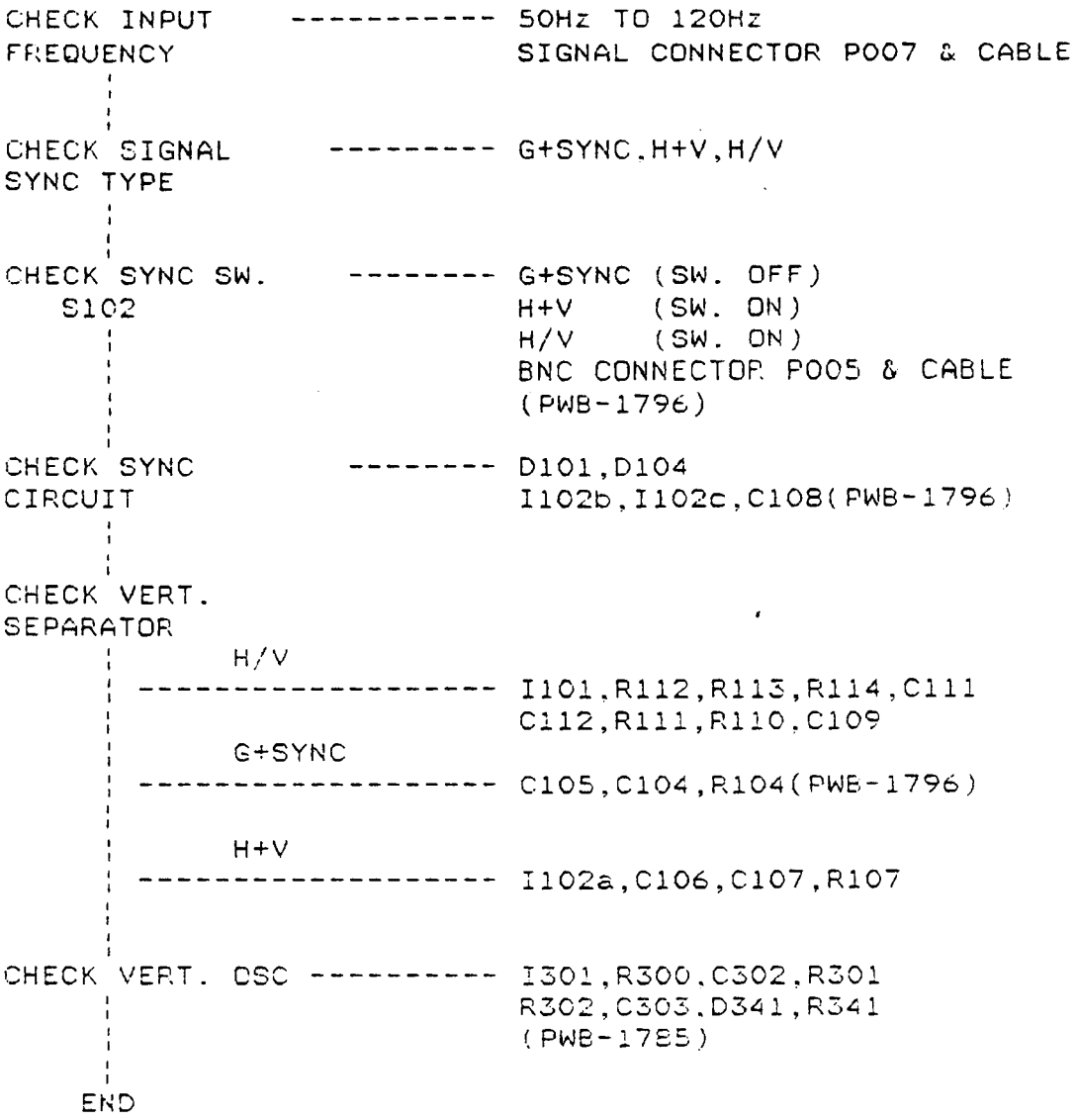
---------- READJUST HOR. OSC (FREE-RUN)
R408,R405,R402 (PWB-1785)
SEE ALIGNMENT ITEM 2.4 (1)

4.24 VERTICAL RASTER CENTERING



4.25 LACK OF STABLE VERTICAL SYNCHRONIZATION

VERTICAL



4.26 LACK OF STABLE HORIZONTAL SYNCHRONIZATION

HORIZONTAL

CHECK INPUT FREQUENCY ---------- 28KHz TO 82KHz

CHECK SIGNAL SYNC TYPE ---------- G+SYNC,H+V,H/V

CHECK SYNC SW. S102 -------- G+SYNC (SW. OFF)
H+V (SW. ON)
H/V (sw. on)
CONNECTOR P004/7 & CABLE
(PWB-1796)

---------- CHECK HOR. SYNC CIRCUIT
Q443,R443,R447,R426,R427
R429,C426,C429

---------- CHECK HOR. AFC CIRCUIT
C430,C431,C433,R430,R431

CHECK SYNC CKT

H/V or H+V
---------- I101,I102a,C105,C107,R100
R115,P010A,P508A(PWB-1796)

G+SYNC
---------- C105,C104,R104(PWB-1796)

READJUST HOR. OSC -------- R408,R405,R402(PWB-1785)
SEE ALIGNMENT ITEM 2.4 (1)

CHECK HOR. OSC ---------- I428,C431,C433,R431,R432
R430,C430

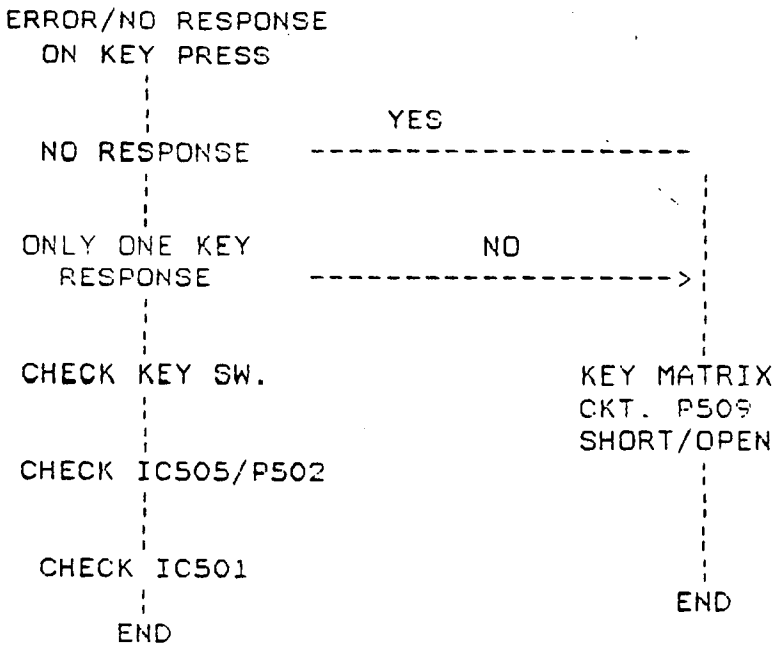
CHECK H. F/V CIRCUIT

---------- I420C,I420D,Q419(PWB-1785)
I402A,I420B,Q412,Q416

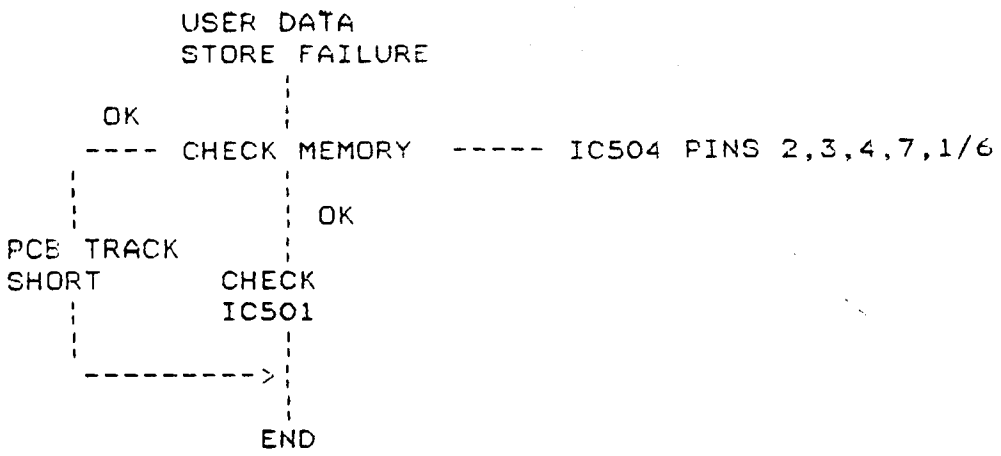
END

4.27 NO KEY RESPONSE (MICRO BOARD FAILURE)

THE CONTROL KEY WILL OPERATE ONLY IF THE SYNC SIGNAL INPUT TO THE MONITOR.

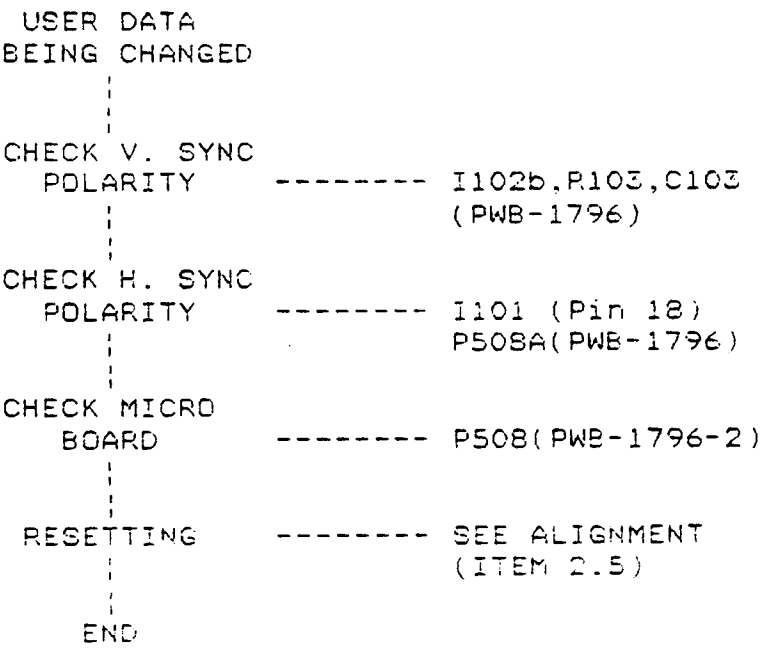


4.28 USER DATA STORE FAILURE (MICRO BOARD FAILURE)

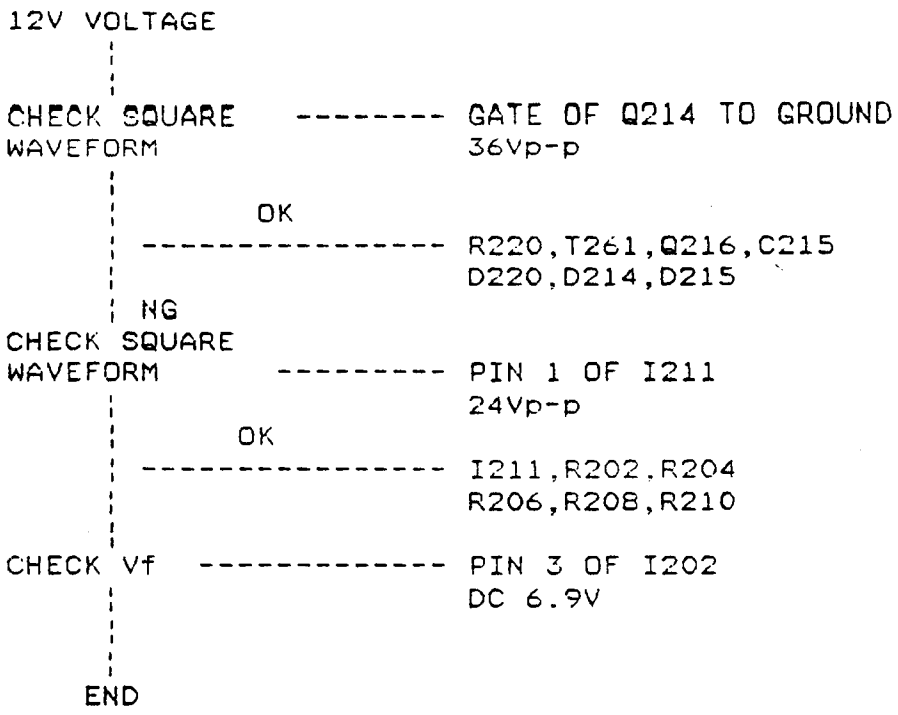


4.29 USER DATA BEING CHANGED (MICRO BOARD FAILURE)

If have any problem on the H. POLARITY or V. POLARITY circuit, the microprocessor will take the different input signals as the same signal and give them the same memory address. So the original data which is written before will be changed at the second-time writing.

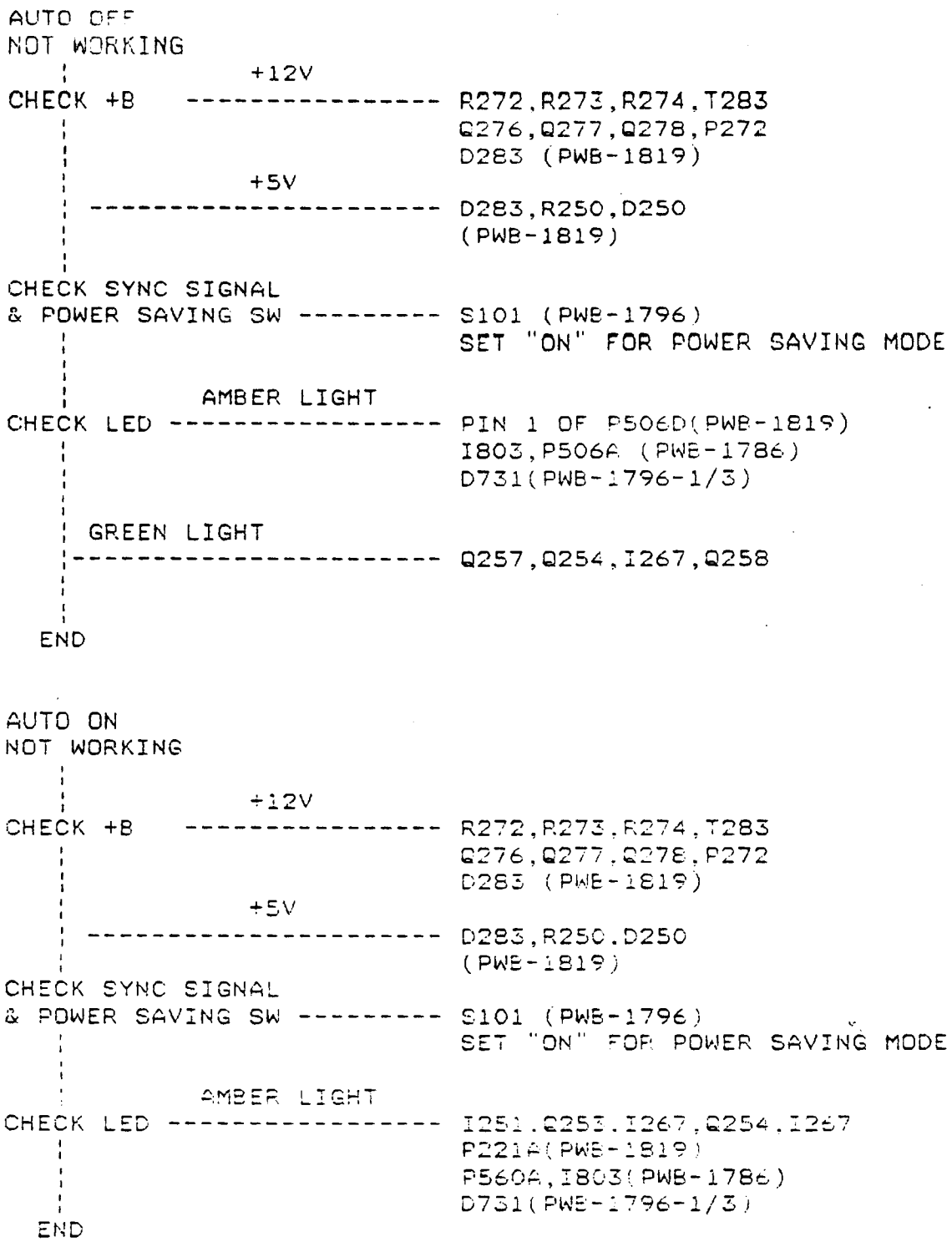


4.30 VIDEO BOARD +12V VOLTAGE FAILURE

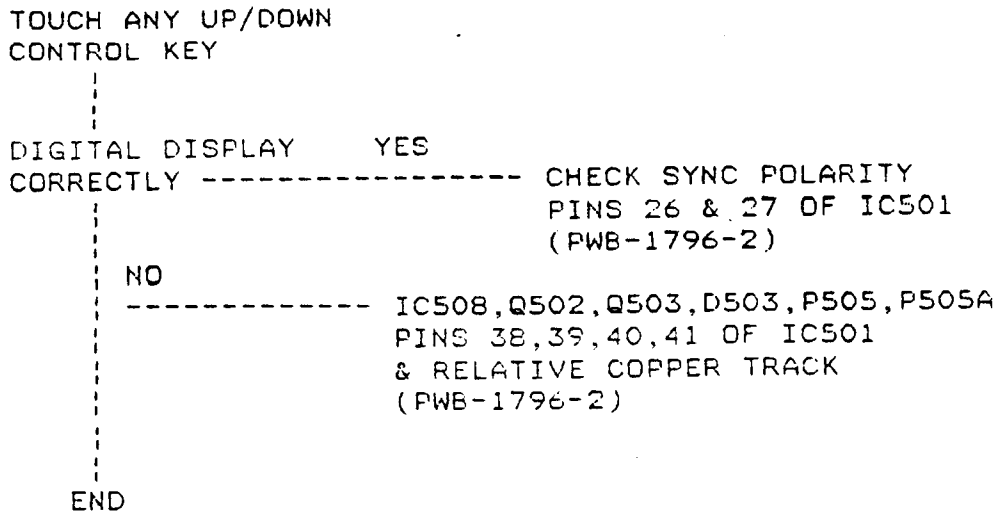


4.31 POWER SAVING FAILURE

THE POWER SAVING IS WORKING ONLY IF THE INPUT SYNC SIGNALS ARE PROPERLY CONNECTED. (REFER TO ITEM 3.6)



4.32 SEVEN SEGMENT DISPLAY FAILURE



5.0 REPLACEMENT PARTS LIST

SYMBOL	PARTS NO.	DESCRIPTION				SYMBOL	PARTS NO.	DESCRIPTION			
R123 R130 R153	5142113295	CARBON	1.8K	J	1/6W	R278 R907 R908	5142843195	CARBON	430	J	1/4W
R124 R154 R184	5142168495	CARBON	680K	J	1/6W	R282	5142891195	CARBON	910	J	1/4W
R127 R157 R187	5142156395	CARBON	56K	J	1/6W	R283	5142868195	CARBON	680	J	1/4W
R132 R212 R255	5142110395	CARBON	10K	J	1/6W	R284 R285 R453	5142810295	CARBON	1K	J	1/4W
R133 R372	5142127395	CARBON	27K	J	1/6W	R286	5130347303	METAL MINI	47K	J	1W
R134 R292 R300	5142147395	CARBON	47K	J	1/6W	R302 R684	5142124395	CARBON	24K	J	1/6W
R135 R214 R215	5142122295	CARBON	2.2K	J	1/6W	R303 R622	5142116395	CARBON	16K	J	1/6W
R136 R356 R426	5142112395	CARBON	12K	J	1/6W	R305	5142191495	CARBON	910K	J	1/6W
R140	5142151195	CARBON	510	J	1/6W	R307	5142191195	CARBON	910	J	1/6W
R156 R186 R317	5142168395	CARBON	68K	J	1/6W	R308	5142112195	CARBON	120	J	1/6W
R159 R213 R563	5142151295	CARBON	5.1K	J	1/6W	R310 R366	5142124295	CARBON	2.4K	J	1/6W
R160 R344 R443	5142168295	CARBON	6.8K	J	1/6W	R312	5142412990	CARBON	1.2	J	1/2W
R182	5142156295	CARBON	5.6K	J	1/6W	R313	5142456190	CARBON	560	J	1/2W
R183 R190 R353	5142118295	CARBON	1.8K	J	1/6W	R316 R422	5142118495	CARBON	180K	J	1/6W
R188 R534 R819	5142810395	CARBON	10K	J	1/4W	R318 R351 R762	5142147395	CARBON	47K	J	1/6W
R203	5134743008	METAL	430	F	1/6W	R320 R833 R835	5130415103	METAL MINI	150	J	2W
R205 R674	5134751018	METAL	5.1K	F	1/6W	R321 R831	5130410103	METAL MINI	100	J	2W
R206 R232 R233	5142156295	CARBON	5.6K	J	1/6W	R324 R329 R371	5142110295	CARBON	1K	J	1/6W
R207 R631 R640	5142182295	CARBON	8.2K	J	1/6W	R341	5142812495	CARBON	120K	J	1/4W
R210	5142147595	CARBON	4.7M	J	1/6W	R345	5142182495	CARBON	820K	J	1/6W
R211 R619 R828	5142822395	CARBON	22K	J	1/4W	R718	5142113495	CARBON	130K	J	1/6W
R218	5130333003	METAL MINI	33	J	1W	R349 R365 R411	5142110395	CARBON	10K	J	1/6W
R219	5130310103	METAL MINI	100	J	1W	R352 R410 R412	5142147395	CARBON	47K	J	1/6W
R223	5142830295	CARBON	3K	J	1/4W	R354 R430 R511	5142147295	CARBON	4.7K	J	1/6W
R231	5142882295	CARBON	8.2K	J	1/4W	R355	5142168195	CARBON	680	J	1/6W
R234 R438 R504	5142115395	CARBON	15K	J	1/6W	R357	5142412190	CARBON	120	J	1/2W
R250	5143813190	CARBON	430	J	1/4W	R359 R404	5142143395	CARBON	43K	J	1/6W
R251	5142130395	CARBON	30K	J	1/6W	R361 R418 R648	5142151395	CARBON	51K	J	1/6W
R252 R627	5142120295	CARBON	2K	J	1/6W	R363	5142810195	CARBON	100K	J	1/4W
R253 R644 R646	5142110195	CARBON	100K	J	1/6W	R373 R419 R424	5142133395	CARBON	33K	J	1/6W
R256 R258	5142110195	CARBON	100	J	1/6W	R735	5142182295	CARBON	8.2K	J	1/6W
R257 R260 R262	5142110295	CARBON	1K	J	1/6W	R400 R403 R425	5142168395	CARBON	68K	J	1/6W
R261 R322 R327	5142110395	CARBON	10K	J	1/6W	R401 R407	5142162395	CARBON	62K	J	1/6W
R273 R274	5130415103	METAL MINI	150K	J	2W	R406	5142156395	CARBON	56K	J	1/6W
R275 R810 R811	5130310103	METAL MINI	100K	J	1W	R409 R641 R704	5142182395	CARBON	82K	J	1/6W
R276	5130347903	METAL MINI	4.7	J	1W	R413	5142182395	CARBON	82K	J	1/6W

SYMBOL	PARTS NO.	DESCRIPTION				SYMBOL	PARTS NO.	DESCRIPTION			
R415 R420 R444	5142110395	CARBON	10K	J	1/6W	R510 R508 R509	5160301402	NETWORK	10K	J	*
R416 R503 R642	5142147395	CARBON	47K	J	1/6W	R512 R520 R656	5142147295	CARBON	4.7K	J	1/6W
R421 R841	5142110395	CARBON	10K	J	1/6W	R513 R514 R515	5142815195	CARBON	150	J	1/4W
R423	5142133595	CARBON	3.3M	J	1/6W	R516 R517 R518	5142815195	CARBON	150	J	1/4W
R428 R683	5142112395	CARBON	12K	J	1/6W	R519	5142815195	CARBON	150	J	1/4W
R429 R472	5142122295	CARBON	2.2K	J	1/6W	R521	5142110095	CARBON	10	J	1/6W
R431 R437 R624	5142133395	CARBON	33K	J	1/6W	R522 R821	5142810095	CARBON	10	J	1/4W
R432 R433 R526	5142110295	CARBON	1K	J	1/6W	R531 R636	5142112495	CARBON	120K	J	1/6W
R435 R445 R626	5142130295	CARBON	3K	J	1/6W	R532 R563 R639	5142118395	CARBON	18K	J	1/6W
R436 R620	5142122395	CARBON	22K	J	1/6W	R535 R560 R562	5142110395	CARBON	10K	J	1/6W
R439	5142818395	CARBON	18K	J	1/4W	R600 R604 R606	5142156295	CARBON	5.6K	J	1/6W
R440 R450 R701	5142168395	CARBON	68K	J	1/6W	R601 R647 R844	5142115395	CARBON	15K	J	1/6W
R441 R650 R728	5142133295	CARBON	3.3K	J	1/6W	R603 R625 R654	5142110395	CARBON	10K	J	1/6W
R442 R651 R709	5142120395	CARBON	20K	J	1/6W	R605	5142147495	CARBON	470K	J	1/6W
R447	5142112295	CARBON	1.2K	J	1/6W	R608 R612 R614	5142156295	CARBON	5.6K	J	1/6W
R448 R451 R533	5142110395	CARBON	10K	J	1/6W	R609 R615	5142168295	CARBON	6.8K	J	1/6W
R449	5142122195	CARBON	220	J	1/6W	R610	5142122095	CARBON	22	J	1/6W
R452	5130539103	METAL MINI	390	J	3W	R611 R619	5142133495	CARBON	330K	J	1/6W
R457 R653 R824	5142815295	CARBON	1.5K	J	1/4W	R616 R755	5142147095	CARBON	47	J	1/6W
R458	5134718028	METAL	18K	F	1/6W	R621	5142116495	CARBON	160K	J	1/6W
R459	5134722028	METAL	22K	F	1/6W	R623 R703	5142122395	CARBON	22K	J	1/6W
R462 R464	5134722038	METAL MINI	220K	F	1/6W	R629 R692	5142156295	CARBON	5.6K	J	1/6W
R463	5134712038	METAL	120K	F	1/6W	R643	5142175395	CARBON	75K	J	1/6W
R465	5134710038	METAL	100K	F	1/6W	R650A	5142130295	CARBON	3K	J	1/6W
R466	5134756028	METAL	56K	F	1/6W	R652	5142139295	CARBON	3.9K	J	1/6W
R467 R470	5142812195	CARBON	120	J	1/4W	R655 R702 R705	5142110395	CARBON	10K	J	1/6W
R473	5154401024	CEMENT	1	J	5W	R657	5142112090	CARBON	12	J	1/2W
R484 R901 R902	5142433090	CARBON	33	J	1/2W	R658	5130482103	METAL MINI	820	J	2W
R485	5130515203	METAL MINI	1.5K	J	3W	R659 R660	5130515103	METAL MINI	150	J	3W
R486 R487	5130322103	CARBON	220	J	1W	R661	5130418903	METAL MINI	1.8	J	2W
R491 R637	5142882395	CARBON	82K	J	1/4W	R662	5142439090	CARBON	39	J	1/2W
R491A R918	5142817395	CARBON	47K	J	1/4W	R663 R664 R912	5142810595	CARBON	1M	J	1/4W
R493 R494 R495	5142110195	CARBON	100	J	1/6W	R671 R682	5142122595	CARBON	2.2M	J	1/6W
R496 R497 R498	5142110195	CARBON	100	J	1/6W	R676	5134711028	METAL	11K	F	1/6W
R499	5130547003	METAL MINI	47	J	3W	R681	5131718038	METAL	180K	F	1/4W
R502 R736	5142847195	CARBON	470	J	1/4W	R686 R713	5142111395	CARBON	11K	J	1/6W

SYMBOL	PARTS NO.	DESCRIPTION				SYMBOL	PARTS NO.	DESCRIPTION			
R687A	5142110595	CARBON	1M	J	1/6W	R836	5142856395	CARBON	56K	J	1/4W
R688	5142133395	CARBON	33K	J	1/6W	R837	5154568125	CEMENT	680	J	7W
R689 R691 R693	5142110295	CARBON	1K	J	1/6W	R838	5142822495	CARBON	220K	J	1/4W
R690 R825 R827	5142810295	CARBON	1K	J	1/4W	R839	5142410190	CARBON	100	J	1/2W
R694	5142856295	CARBON	5.6K	J	1/4W	R842 R850	5142115195	CARBON	150	J	1/6W
R697	5154422224	CEMENT	2.2K	J	5W	R843	5142124495	CARBON	240K	J	1/6W
R698	5130510203	METAL MINI	1K	J	3W	R845	5142822295	CARBON	2.2K	J	1/4W
R706	5142191295	CARBON	9.1K	J	1/6W	R903	5142433090	CARBON	33	J	1/2W
R707	5142162495	CARBON	620K	J	1/6W	R909	5142843195	CARBON	430	J	1/4W
R708 R711	5142110195	CARBON	100K	J	1/6W	R911	5142811495	CARBON	110K	J	1/4W
R710 R719	5142151395	CARBON	51K	J	1/6W	R913	5142822095	CARBON	22	J	1/4W
R712	5142120395	CARBON	20K	J	1/6W	R914	5142810195	CARBON	100	J	1/4W
R716	5142168395	CARBON	68K	J	1/6W	R915	5142810595	CARBON	1M	J	1/4W
R717	5130433103	METAL MINI	330	J	2W	R917	5142436290	CARBON	3.6K	J	1/2W
R720 R731	5142110295	CARBON	1K	J	1/6W						
R723 R724	5130533303	METAL MINI	33K	J	3W						
R726	5142836395	CARBON	36K	J	1/4W						
R727	5142118395	CARBON	18K	J	1/6W						
R733	5142427490	CARBON	270K	J	1/2W						
R751	5142416490	CARBON	160K	J	1/2W						
R752	5142412490	CARBON	120K	J	1/2W						
R760 R832	5142810395	CARBON	10K	J	1/4W						
R801	5131710048	METAL	1M	F	1/4W						
R802 R803	5130191203	METAL MINI	9.1K	J	2W						
R804	5131718028	METAL	18K	F	1/4W						
R805	5134782028	METAL	82K	F	1/6W						
R806	5142139195	CARBON	390	J	1/6W						
R807	5142433490	CARBON	330K	J	1/2W						
R813	5130547303	METAL MINI	47K	J	3W						
R814 R847	5130456303	METAL MINI	56K	J	2W						
R816	5142812095	CARBON	12	J	1/4W						
R817	5142891295	CARBON	9.1K	J	1/4W						
R818	5142820195	CARBON	200K	J	1/4W						
R822	5142816295	CARBON	1.6K	J	1/4W						
R829	5130121803	METAL MINI	0.24	J	2W						
R830	5154525225	CEMENT	2.5K	J	7W						
R834	5142812395	CARBON	12K	J	1/4W						

**** CAPACITORS ****

SYMBOL	PARTS NO.	DESCRIPTION				SYMBOL	PARTS NO.	DESCRIPTION			
C001 C004 C005	5293347091	ELEC MINI	47u	M	16V	C213 C232 C307	5231310291	CERAMIC CK45	1000P	K	50V
C003	5275110391	METAL CF93M	10000P	J	63V	C216 C304 C501	5213547091	ELEC	47u	M	35V
C006 C009 C010	5231810391	CERAMIC CK45	10000P	Z	50V	C217 C220 C809	5213422191	ELEC	220u	M	25V
C007 C014 C031	5293347091	ELEC MINI	47u	M	16V	C218 C223 C265	5236310191	BARRIER CG45X	0.1u	Z	50V
C008 C038 C068	5213622991	ELEC	2.2u	M	50V	C219	5223410301	POLY CQ93T	10000P	J	250V
C012 C016 C036	5231810391	CERAMIC CK45	10000P	Z	50V	C220 C809	5213422191	ELEC	220u	M	25V
C015 C045 C075	5242215191	CERAMIC CC45	150P	J	50V	C221 C434 C452	5213347112	ELEC	470u	M	16V
C017 C047 C077	5271110301	METAL CF93M	1u	J	100V	C222 C643 C653	5213447091	ELEC	47u	M	25V
C018 C078 C302	5221110401	POLY CQ93M	0.1u	J	100V	C231 C505 C506	5242220091	CERAMIC CC45	20P	J	50V
C019	5214147012	ELEC	47u	M	100V	C251 C472 C707	5213633991	ELEC	3.3u	M	50V
C033 C063 C107	5275110391	METAL CF93M	10000P	J	63V	C272 C275	5232310301	CERAMIC CK45	10000P	K	500V
C035 C037 C044	5293347091	ELEC MINI	47u	M	16V	C277 C285 C357	5236310191	BARRIER CG45X	0.1u	Z	50V
C039 C042 C066	5231810391	CERAMIC CK45	10000P	Z	50V	C278	5227524200	POLY CQ93T	2400P	G	100V
C043 C073 C131	5213610091	ELEC	10u	M	50V	C279 C283 C833	5215410191	ELEC	100u	M	25V
C046	5234840391	CERAMIC CK45	10000P	Z	50V	C299	5213210191	ELEC	100u	M	10V
C061 C065 C067	5293347091	ELEC MINI	47u	M	16V	C300	5213510191	ELEC	1000u	M	35V
C069 C072 C076	5231810391	CERAMIC CK45	10000P	Z	50V	C301	5231368191	CERAMIC CK45	680P	K	50V
C074 C133 C504	5293347091	ELEC MINI	47u	M	16V	C303	5275133491	METAL CF93M	0.33u	J	63V
C102 C111 C112	5231310291	CERAMIC CK45	1000P	K	50V	C305 C306 C329	5275110191	METAL CF93M	0.1u	J	63V
C103 C136 C366	5213647991	ELEC	4.7u	M	50V	C308	5213622112	ELEC	220u	M	50V
C104	5275147291	METAL CF93M	4700P	J	63V	C309	5222522401	POLY C092M	0.22u	K	100V
C105 C106 C109	5293622991	ELEC MINI	2.2u	M	50V	C310	5213601091	ELEC	1u	M	50V
C108	5293647991	ELEC MINI	4.7u	M	50V	C313 C822	5210103501	ELEC	1000u	M	35V
C115 C141 C209	5236310191	BARRIER CG45X	0.1u	Z	50V	C353	5231322191	CERAMIC CK45	220P	K	50V
C116	5247012191	CERAMIC CC45	120P	J	50V	C358	5231810391	CERAMIC CK45	10000P	Z	50V
C118 C148 C178	5221110391	POLY CQ93M	10000P	J	50V	C359 C638 C815	5213610091	ELEC	10u	M	50V
C119	5247039091	CERAMIC CC45	39P	J	50V	C363 C451	5213601091	ELEC	1.0u	M	50V
C120 C127	5214122991	ELEC	2.2u	M	100V	C403 C410 C411	5236310191	BARRIER CG45X	0.1u	Z	50V
C125	5214110091	ELEC	10u	M	100V	C415 C416 C435	5236310191	BARRIER CG45X	0.1u	Z	50V
C132 C206 C439	5275122491	METAL CF93M	0.22u	J	63V	C420	5213622991	ELEC	2.2u	M	50V
C157	5214122991	ELEC	2.2u	M	50V	C422	5221110391	POLY CQ93M	10000P	J	50V
C187 C286	5214122991	ELEC	2.2u	M	100V	C425 C642 C681	5213647991	ELEC	4.7u	M	50V
C190 C253 C319	5213610091	ELEC	10u	M	50V	C426 C600 C687	5242222091	CERAMIC CC45	22P	J	50V
C201 C659	5213522112	ELEC	220u	M	35V	C428	5242227191	CERAMIC CC45	270P	J	50V
C203 C215 C436	5231310391	CERAMIC CK45	10000P	K	50V	C429 C449 C601	5242210191	CERAMIC CC45	100P	J	50V

SYMBOL	PARTS NO.	DESCRIPTION				SYMBOL	PARTS NO.	DESCRIPTION			
C431	5221112391	POLY CQ93M	2200P	J	100V	C637	5216233991	ELEC	3.3u	M	160V
C433	5227522291	POLY CQ93T	2200P	G	100V	C646	5214401091	ELEC	1u	M	250V
C441	5210500891	ELEC	1u	M	50V	C651	5227510291	POLY CQ93T	1000P	G	100V
C445 C447 C493A	5236310491	BARRIER CG45X	0.1u	Z	50V	C658	5231315291	CERAMIC CK45	1500P	K	50V
C448 C688 C705	5242282091	CERAMIC CC45	82P	J	50V	C661 C691	5215422091	ELEC	22u	M	25V
C450	5242256091	CERAMIC CC45	56P	J	50V	C662	5223718202	POLY CQ93T	1800P	J	1600V
C454	5213610191	ELEC	100u	M	50V	C665 C666	5270747301	METAL CF93T	47000P	J	630V
C455 C607	5213622091	ELEC	22u	M	50V	C676 C810 C827	5236310191	BARRIER CG45X	0.1u	Z	50V
C459 C508 C526	5231310291	CERAMIC CK45	1000P	K	50V	C689	5231347291	CERAMIC CK45	4700P	K	50V
C466 C602 C609	5231310391	CERAMIC CK45	10000P	K	50V	C697	5223622201	POLY CQ93T	2200P	J	630V
C468	5223711202	POLY CQ93T	4300P	J	1600V	C699	5216122012	ELEC	22u	M	250V
C469	5223736202	POLY CQ93T	3600P	J	1600V	C702	5272110301	METAL CF93M	10000P	J	250V
C471	5231322291	CERAMIC CK45	2200P	K	50V	C432	5275118291	METAL CF93M	1800P	J	63V
C485 C667 C701	5272110401	METAL CF93M	0.1u	J	250V	C704	5221168301	POLY CQ93M	68000P	J	50V
C486 C487	5232310291	CERAMIC CK45	1000P	K	500V	C706	5242218191	CERAMIC CC45	180P	J	50V
C493	5223112401	POLY CQ93T	0.12u	J	250V	C708	5213633991	ELEC	3.3u	M	50V
C494A C495A C496A	5236310191	BARRIER CG45X	0.1u	Z	50V	C709	5223715201	POLY CQ93T	1500P	J	1600V
C468	5270601402	METAL CF93T	1u	J	250V	C725	5215610091	ELEC	10U	M	50V
C497 C498	5270601502	METAL CF93T	1u	J	250V	C726	5231312291	CERAMIC CK45	1200P	K	50V
C497A C498A C621	5236310491	BARRIER CG45X	0.1u	Z	50V	C761	5275110191	METAL CF93M	0.1u	J	63V
C502 C606	5213547091	ELEC	47u	M	35V	C802 C803	5270106601	METAL CF99M	6.8u	M	250V
C503 C623 C723	5275110191	METAL CF93M	0.1u	J	63V	C804 C805	5230102701	CERAMIC CK45	4700P	M	400V
C507	5292210091	ELEC MINI	10u	M	16V	C806 C807	5210306800	ELEC	470u	M	250V
C511 C512	5213317091	ELEC	47u	M	16V	C808	5223656201	POLY CQ93T	5600P	J	630V
C513	5247018191	CERAMIC CC45	180P	J	50V	C811	5293622991	ELEC MINI	2.2u	M	50V
C603 C617 C812	5231310291	CERAMIC CK45	1000P	K	50V	C813	5222410291	POLY CQ92M	1000P	J	100V
C604 C760	5231347191	CERAMIC CK45	470P	K	50V	C814	5221147291	POLY CQ93M	4700P	J	50V
C608 C671 C703	5275122491	METAL CF93M	0.22u	J	63V	C817 C908	5234310101	CERAMIC CK45	100P	K	2KV
C610 C617	5216117912	ELEC	4.7u	M	250V	C818	5216110101	ELEC	100u	M	250V
C611	5216001901	CE04CH	47u	M	160V	C819	5232315191	CERAMIC CK45	150P	K	500V
C613	5215622091	ELEC	22u	M	50V	C820	5216110112	ELEC	100u	M	100V
C614 C682 C683	5231310391	CERAMIC CK45	10000P	K	50V	C821 C823	5232333191	CERAMIC CK45	330P	K	500V
C615	5275147391	METAL CF93M	47000P	J	63V	C824	5213003591	ELEC	470u	M	16V
C616 C618	5216122912	ELEC	2.2u	M	250V	C825	5248556100	CERAMIC CC45	560P	K	2KV
C619	5213006312	ELEC	2.2u	M	250V	C825	5248556101	CERAMIC CC45	560P	K	2KV
C628 C644 C801	5242210191	CERAMIC CC45	100P	J	50V	C826	5213333091	ELEC	33u	M	16V
C629 C679 C816	5213617091	ELEC	47u	M	50V	C828	5216410001	ELEC	10u	M	250V
C630	5275147181	METAL CF93T	0.47u	J	63V	C829	5216147012	ELEC	47u	M	100V

SYMBOL	PARTS NO.	DESCRIPTION			
C830	5215547112	ELEC	470u	M	35V
C832	5214701091	ELEC	1u	M	450V
C836	5232310191	CERAMIC CK45	100P	K	500V
C837	5231310391	CERAMIC CK45	10000P	K	50V
C901	5233510301	CERAMIC CK45	10000P	K	1KV
C904	5270322401	METAL CF93T	0.22u	J	250V
C909	5233510201	CERAMIC CK45	1000P	M	1KV
C912	5236310491	BARRIER CG45X	0.1u	Z	50V

**** DIODES ****

SYMBOL	PARTS NO.	DESCRIPTION		SYMBOL	PARTS NO.	DESCRIPTION	
D012 D013 D014	6613001934	SWITCHING	1SS133	D351 D353 D402	6613003032	SWITCHING	1N4148-TD
D015 D233 D412	6615011130	ZENER	HZS8.2EB2TJ-TD	D403 D425 D438	6613003037	SWITCHING	1N4148
D015 D233 D412	6615007341	ZENER	MA1082L-TP	D403 D425 D438	6613003032	SWITCHING	1N4148-TD
D042 D043 D044	6613001934	SWITCHING	1SS133	D416	6615013130	ZENER	HZS8.2TJ-TD
D072 D073 D074	6613001934	SWITCHING	1SS133	D416 D600 D687	6615007341	ZENER	MA1082L-TP
D101 D102 D103	6613003037	SWITCHING	1N4148	D445	6615006631	ZENER	05AZ6.2Z
D101 D102 D103	6613003032	SWITCHING	1N4148-TD	D452 D502 D605	6615005833	ZENER	RD12E-B3-T1
D104 D131 D202	6613003037	SWITCHING	1N4148	D452 D502 D605	6615005803	ZENER	RD12E-B3
D104 D131 D202	6613003032	SWITCHING	1N4148-TD	D456	6615023730	ZENER	HZ15-3-TD
D121 D123 D124	6613001531	SWITCHING	1SS131	D467 D470	6611001800	RECTIFIER	RK14
D125 D217 D218	6611000341	RECTIFIER	1N4935-G23	D468	6611032000	RECTIFIER	CTUG30R
D125 D217 D218	6613002244	SWITCHING	RGP10D-G23	D468A	5077303600	INSULATOR	IS-3MPC
D132 D133 D134	6613001934	SWITCHING	1SS133	D468B	5037100100	COMPOUND	TSK-551
D135	6613001934	SWITCHING	1SS133	D469 D483 D665	6611001900	RECTIFIER	RG2A
D151 D153 D154	6613001531	SWITCHING	1SS131	D484 D630 D637	6611034430	RECTIFIER	EGP10G-G3
D181 D183 D184	6613001531	SWITCHING	1SS131	D487 D525 D526	6613003037	SWITCHING	1N4148
D203	6615006631	ZENER	05AZ6.2Z-TP3	D487 D525 D526	6613003032	SWITCHING	1N4148-TD
D203 D445 D675	6615009756	ZENER	HZ6C2-TD	D503	6618006700	DISPLAY	CSD-322G
D214 D501	6615005235	ZENER	HZ16-2-TD	D600 D687	6615013130	ZENER	HZS8.2EB2TJ-TD
D214 D501	6615005234	ZENER	RD16EB3-T1	D601 D602 D603	6613003037	SWITCHING	1N4148
D215 D216 D302	6613003037	SWITCHING	1N4148	D601 D602 D603	6613003032	SWITCHING	1N4148-TD
D215 D216 D302	6613001032	SWITCHING	1N4148-TD	D604 D608 D609	6613003037	SWITCHING	1N4148
D220 D610 D616	6611027700	RECTIFIER	UF5404	D604 D608 D609	6613003032	SWITCHING	1N4148-TD
D222 D250 D653	6615003101	ZENER	1N5231B	D614 D615 D623	6613003037	SWITCHING	1N4148
D222 D250 D653	6615003131	ZENER	1N5231B-RL	D614 D615 D623	6613003032	SWITCHING	1N4148-TD
D232 D322 D358	6615005803	ZENER	RD12E-B3	D624 D688	6615005803	ZENER	RD12E-B3
D232 D322 D358	6615005833	ZENER	RD12E-B3-T1	D624 D688	6615005833	ZENER	RD12E-B3-T1
D251 D323 D909	6615016430	ZENER	HZ3A2-TD	D638	6615009720	ZENER	RD11EB3-T1
D275	6611032640	RECTIFIER	BYV26D	D639 D643 D676	6613003037	SWITCHING	1N4148
D278	6615006434	ZENER	RD6.2EB3-T1	D639 D643 D676	6613003032	SWITCHING	1N4148-TD
D279 D283 D806	6613002244	SWITCHING	RGP10D-G23	D646 D647 D901	6613002245	SWITCHING	RGP10G-G23
D301	6611007240	RECTIFIER	1N4002RL	D662	6611029642	RECTIFIER	RU4D-V1
D341	6615002400	ZENER	HZ4C3	D666	6611034430	RECTIFIER	EGP10G-G3
D341	6615002430	ZENER	HZ4C3-TD	D675	6615006631	ZENER	05AZ6.2-TP3
D351 D353 D402	6613003037	SWITCHING	1N4148	D689	6615003101	ZENER	1N5231B

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SYMBOL	PARTS NO.	DESCRIPTION	
D689	6615003131	ZENER	1N5231B-RL
D689	6615007832	ZENER	HZ5C3-TD
D691	6615003731	ZENER	RD13FB3-T1
D697 D699	6611001900	RECTIFIER	RG2A
D701	6611012811	RECTIFIER	RGP10M-G23
D701 D803	6611012801	RECTIFIER	RGP10M
D702	5142843395	CARBON	43K
D705	6615005843	ZENER	RD12E-B3-T2
D732 D805 D814	6613003037	SWITCHING	1N4148
D732 D805 D814	6613003032	SWITCHING	1N4148-TD
D801	6611007740	RECTIFIER	1N4007-G23
D802	6611002000	RECTIFIER	D5SB60
D802	6611000601	RECTIFIER	RBV-606
D803	6611012811	RECTIFIER	RGP10M-G23
D804 D818	6611007610	RECTIFIER	1N4006-G23
D806	6611000341	RECTIFIER	1N4935-G23
D807	6615019032	ZENER	MA180H-TA
D808	6611032341	RECTIFIER	2NU41-TPA1
D808	6611032342	RECTIFIER	RG1C
D809	6611027744	RECTIFIER	3GU41-TP
D809	6611027700	RECTIFIER	UF5404
D810	6611000244	RECTIFIER	BYW98-200
D810	6611028010	RECTIFIER	UG1D-G23
D811	6611015243	RECTIFIER	FUF5402
D811	6611015242	RECTIFIER	UF5402-G4
D812	6615006246	ZENER	1N5245B-RL
D813	6611017441	RECTIFIER	RGP10K-G23
D815	6615023230	ZENER	1N5248B
D815	6615019032	ZENER	MA4180H-TA
D816	6613003037	SWITCHING	1N4148
D816	6613003032	SWITCHING	1N4148-TD
D902	6613002245	SWITCHING	RGP10G-G23
D903	6615011333	ZENER	1N5252B-RL
D904 D905 D906	6615013831	ZENER	HZ33-2-TD
D907 D908	6615013831	ZENER	HZ33-2-TD

*** COILS & TRANSFORMERS ***

SYMBOL	PARTS NO.	DESCRIPTION	
L001 L031 L061	5062122404	I.C	ZJSCR12-100-TA
L017 L047 L077	5062121301	CHOKE	CHK-213A
L018 L048 L078	5062121200	CHOKE	CHK-212
L021	5061427929	PEAKING	TRF-8279J
L217	5062121800	CHOKE	CHK-218
L487	5062226800	LINEARITY	TLH-268
L489 L610 L616	5062123500	CHOKE	CHK-235
L499	5062117700	CHOKE	CHK-177
L611 L618 L619	5062117600	CHOKE	CHK-176
L661	5064422929	PEAKING	TRF-8229J
L699	5062117600	CHOKE	CHK-176
L801	5061108901	TRANSFORMER	TLF-089A
L802 L807	5062123000	CHOKE	CHK-230
L803 L804	5062202300	CHOKE	TLN-2026
L805	5062119000	CHOKE	CHK-190
L811	5061107401	SOCKET	TNF-001
L811A L811B L811C1	5075500609	SHRINK	4X0.25MM
L811C	5057201702	GROUND	UL1015CSA
L902 L903 L904	5062102500	CHOKE	TRF-1019

**** SPARK GAP ***

SYMBOL	PARTS NO.	DESCRIPTION	
SG701	5202200501	SPARK GAP SG05G	1KV 1PF
SG701	5202200502	SPARK GAP	1KV 1PF
SG701	5202200591	SPARK GAP	1KV 1PF
Z901	5202201991	SPARK GAP	DC200V 1PF
Z902	5202201991	SPARK GAP	DC200V 1PF
Z903	5202201991	SPARK GAP	DC200V 1PF
Z905	5202202300	SPARK GAP	DC300V 1PF

**** FUSE / SWITCH / CONNECTORS ****

SYMBOL	PARTS NO.	DESCRIPTION	
F801	5054425031	FUSE	250V/2.5A
F801A	5056306400	FHC-015	PWB
RY487	5054600101	OMRON	10A
S101 S102	5054519922	SWITCHING 250V	DC30V 0.1A
S501 S502 S503	5054512951	SKHHAM2520-TT	DC12V 50MA
S504 S505 S506	5054512951	SKHHAM2520-TT	DC12V 50MA
S507 S508 S509	5054512951	SKHHAM2520-TT	DC12V 50MA
S510 S511 S512	5054512951	SKHHAM2520-TT	DC12V 50MA
S513	5054512951	SKHHAM2520-TT	DC12V 50MA
S801	5054524434	PUSH DPST	AC250V 5A
S801	5054524489	PUSH DPST CANAL	AC250V 7.5A
S801	5054524490	PUSH DPST RONG FENG	AC250V 10A
S801B S801C	5075500709	HEARED SHRINK TUBE	5X0.25MM
S801D	6140071911	PVC DOUBLE INSULATED	UL1617CSA
S801F S801G	5075500709	SHRINK TUBE	5X0.25MM
S801H	5071000511	QUICK TIE,PVC	2.5 X80MM
SR801	5054600101	RELAY OMRON	10A
T216	5062416700	HOR DRIVE 250V	TLN-167
T283	5061357300	SWITCHING	TPW-573
T467 T661	5062416500	HOR DRIVE	TLN-165
T468	5062416600	DUMMY LOAD	TDL-166
T608 T614	5061348700	SWITCHING	TPW-487

SYMBOL	PARTS NO.	DESCRIPTION	
T801	5061358500	SWITCHING	TPW-585
U201	5053217960	VIDEO/UP/DYNAMIC	PWB-1796
U250	5053218190	POWER SAVING BOARD	PWB-1819
U801	5053217860	POWER BOARD	PWB-1786
U901	5053218470	DRIVE BOARD	PWB-1847
V901B	5056306709	SOCKET	HPS0380-01-110
VP907	5162162880	PN06T4B104AR	100K
W801 W802 W803	6176560602	COATING	600V 5A
X301	6699000904	CRYSTAL UNIT	4MHZ
X501	6699000905	CRYSTAL UNIT	4MHZ

SYMBOL	PARTS NO.	DESCRIPTION			
	****	POSITOR ****			
R808 R840	5101111001	HARRIS V140LA2	*	*	*
R809	5101111400	SCK055	5	*	*
R846	5101106100	PTH451A02BC08N140	*	*	*
	****	FUSIBLE RESISTOR ****			
R044 R530 R617	5133101003	FUSIBLE	1	J	1/2W
R201 R483 R607	5133147903	FUSIBLE	4.7	J	1/2W
R217 R220 R272	5133122903	FUSIBLE	2.2	J	1/2W
R350	5133110003	FUSIBLE	10	J	1/2W
R454 R456 R695	5133147003	FUSIBLE	47	J	1/2W
R455 R471 R492	5133122903	FUSIBLE	2.2	J	1/2W
R613 R696 R699	5133147903	FUSIBLE	4.7	J	1/2W
R618 R630 R665	5133122903	FUSIBLE	2.2	J	1/2W
R666	5133122903	FUSIBLE	2.2	J	1/2W
R812	5133350803	FUSIBLE	0.5	J	2W
R815	5133839003	FUSIBLE	39	J	1/4W
	****	VARIABLE RESISTOR ****			
R009 R039 R069	5162161920	PN06FB103AR	10K	M	*
R129 R189 R638	5162161920	PN06FB103AR	10K	M	*
R204	5162161020	PN06FB102AR	1K	M	*
R402 R405	5162162680	PN06T4B503AR	50K	*	*
R408	5162162280	PN06TB223AR	22K	*	*
R561	5160807160	RV12FB102EKHR-CC	1K	*	*
R564	5160807219	VR12FB103EKHR	10K	*	*
R628*	5162161220	PN06FB202AR	2K	M	*
R675	5162162620	PN06FB503AR	50K	M	*
R685	5162161720	PN06FB502AR	5K	M	*
R721	5162163480	PN06T4B474AR	470K	M	*
R823	5162470820	RV08FB501AR	500	M	0.1W

SYMBOL	PARTS NO.	DESCRIPTION			
	****	RESISTER ****			
R001 R031 R061	5142175095	CARBON	75	J	1/6W
R002 R032 R062	5142115395	CARBON	15K	J	1/6W
R003 R033 R063	5142130195	CARBON	300	J	1/6W
R004 R034 R064	5142147295	CARBON	4.7K	J	1/6W
R006 R036 R066	5142122195	CARBON	220	J	1/6W
R007 R024 R037	5142110395	CARBON	10K	J	1/6W
R008 R038 R068	5142162295	CARBON	6.2K	J	1/6W
R010 R040 R070	5142182395	CARBON	82K	J	1/6W
R011 R022 R041	5142110295	CARBON	1K	J	1/6W
R012 R042 R072	5142820195	CARBON	200	J	1/4W
R014	5130339103	METAL MINI	390	J	1W
R015 R021 R023	5142110195	CARBON	100	J	1/6W
R016 R046 R076	5142136095	CARBON	36	J	1/6W
R017 R047 R077	5130420003	METAL MINI	20	J	2W
R018 R048 R078	5142175195	CARBON	750	J	1/6W
R019 R020 R049	5130718103	METAL MINI	180	J	5W
R025 R100 R202	5142139295	CARBON	3.9K	J	1/6W
R050 R079 R080	5130718103	METAL MINI	180	J	5W
R067 R106 R113	5142110395	CARBON	10K	J	1/6W
R071 R105 R141	5142110295	CARBON	1K	J	1/6W
R083 R131 R254	5142110195	CARBON	100	J	1/6W
R101 R102	5142147195	CARBON	470	J	1/6W
R103	5142133195	CARBON	330	J	1/6W
R104 R208 R209	5142110495	CARBON	100K	J	1/6W
R107 R427 R431	5142118395	CARBON	18K	J	1/6W
R108 R128 R158	5142810395	CARBON	10K	J	1/4W
R109 R117 R259	5142147295	CARBON	4.7K	J	1/6W
R110 R111 R126	5142168395	CARBON	68K	J	1/6W
R112 R122 R152	5142156295	CARBON	5.6K	J	1/6W
R114 R119 R714	5142127295	CARBON	2.7K	J	1/6W
R115 R221 R280	5142810295	CARBON	1K	J	1/4W
R116 R301	5142827395	CARBON	27K	J	1/4W
R120 R150 R180	5142110595	CARBON	1M	J	1/6W

*** TRANSISTOR ***

SYMBOL	PARTS NO.	DESCRIPTION	
Q001 Q031 Q061	6621005035	NPN HF	2SC388A
Q010 Q117 Q131	6621015332	NPN HF	2SC1815Y
Q012 Q042 Q072	6621014530	NPN HF	2SC1906
Q015 Q045 Q075	6621035500	NPN HF	2SC3613
Q016 Q046 Q076	6621003600	NPN HF	2SC3599E
Q016 Q046 Q076	6621003601	NPN HF	2SC4479
Q016A Q016A Q076A	5077302000	SILICON RUBBER	KE5606
Q016B Q046B Q076B	5037100100	SILICON COMPOUND	TSK-551
Q121	6623001501	PNP HF	2SA9049-Y
Q122 Q152 Q182	6621014635	NPN HF	2SC2229Y
Q133 Q140 Q214	6621015332	NPN HF	2SC1815Y
Q134 Q233 Q253	6623002050	PNP HF	2SA1015Y
Q151 Q181	6623004501	PNP HF	2SA949-Y
Q216 Q610 Q616	6626000401	FET MOS	2SK1917
Q231 Q254 Q257	6621015332	NPN HF	2SC1815Y
Q258 Q277 Q279	6621015332	NPN HF	2SC1815Y
Q276	6621038100	NPN HF	KSC5027-R
Q278 Q303 Q329	6623002050	PNP HF	2SA1015Y
Q120	6624001300	PNP LF	2SB772
Q321	6622018000	NPN LF	2SD882Q
Q151 Q443 Q454	6621015332	NPN HF	2SC1815Y
Q153	6621035930	NPN HF	2SC3811Q
Q155	6621019330	NPN HF	2SC1685
Q156 Q412 Q116	6623002050	PNP HF	2SA1015Y
Q119 Q453 Q502	6623002050	PNP HF	2SA1015Y
Q119	6623003432	PNP HF	2SA733P-T
Q149	6623003401	PNP HF	2SA733Q
Q149	6623003431	PNP HF	2SA733Q-T
Q155	6624007400	PNP LF	2SB861WC
Q155A Q468B Q616A	5037100109	SILICON COMPOUND	TSK-551
Q156 Q193 Q194	6626002300	FET MOS	2SK947
Q168	6621038300	NPN HF	2SC4897
Q168A	5077303600	MICA INSULATOR	IS-3MPC
Q191 Q192 Q303	6621015332	NPN HF	2SC1815Y

SYMBOL	PARTS NO.	DESCRIPTION	
Q497 Q498	6625004600	FET MOS	2SK1015
Q601 Q603 Q604	6623002050	PNP HF	2SA1015Y
Q613 Q656 Q705	6621015332	NPN HF	2SC1815Y
Q654	6621035930	NPN HF	2SC3811Q-TA
Q658	6625003200	FET	2SK430
Q662	6621005400	NPN HF	2SC3884A
Q662B Q705B	5037100100	SILICON COMPOUND	TSK-551
Q693	6623003301	PNP HF	2SA952L
Q693	6623003331	PNP HF	2SA952L-T
Q694	6621029100	NPN HF	2SC1384R
Q697	6626003200	FET MOS	2SK1507
Q701 Q702 Q704	6621037400	NPN HF	2SC4686A
Q706 Q802 Q803	6621015332	NPN HF	2SC1815Y
Q801	6625005200	FET MOS	2SK1794
Q801	6626000900	FET MOS	2SK727
Q801	6626002200	FET MOS	2SK794
Q801A	5077303700	SILICON RUBBER	0.3MM
Q801B	5077300700	WASHER	AC302
Q801	6623002050	PNP HF	2SA1015Y
Q805	6632000401	TRIAC	AVS08CRI
Q806	6631001731	SCR	SFOR1B42
Q901	6621013800	NPN HF	2SC1921

****** INTERGRATED CIRCUIT *****

SYMBOL	PARTS NO.	DESCRIPTION	
I101	6614076800	LINEAR	M52036SP
I102	6616009923	DIGITAL	GD74LS86
I102	6616009922	DIGITAL	HD74LS86
I102	6616009910	DIGITAL	SN74LS86
I201	6610005202	VOLTAGE REGULATOR	LM317T
I201A I301A	5037100100	SILICON COMPOUND	TSK-551
I202 I440 I458	6614073000	LINEAR	HA17358
I202 I440 I458	6614008104	LINEAR BIPOLOR	LM358N
I202 I440 I458	6614008105	LINEAR	LM358N
I202 I440 I458	6614008103	LINEAR	LM358P
I202 I440 I458	6614008107	LINEAR BIPOLOR	TA75358P
I202 I440 I458	6614008102	LINEAR	UPC358C
I211 I267 I606	6614077300	LINEAR	HA17393
I211 I267 I606	6614042400	LINEAR	LM393
I211 I267 I606	6614042105	LINEAR	LM393N
I211 I267 I606	6614042404	LINEAR	TA75393P
I251 I650 IC503	6616021000	DIGITAL TTL	74LS122N
I301	6614045200	LINEAR	TDA1670A
I301	6614045202	LINEAR	TDA1675
I301	6614045201	LINEAR	TDA1675A
I362 I420	6614042000	LINEAR	HA17324
I362 I420	6614006703	LINEAR	LM324N
I362 I420	6614026100	LINEAR	TA75902P
I362 I420	6614006702	LINEAR	LM324N
I366 I702	6614032100	LINEAR	M51392P
I401	6615011100	DIGITAL MOS	TC4066BP
I401	6615011500	DIGITAL MOS	UPD4066BC
I428	6614060200	LINEAR	LA7851
I622	6614008130	LINEAR	LM358P
I622 I638 I682	6614073000	LINEAR	HA17358
I622 I638 I682	6614008104	LINEAR BIPOLOR	LM358N
I622 I638 I682	6614008105	LINEAR	LM358N
I622 I638 I682	6614008107	LINEAR BIPOLOR	TA75358P
I622 I638 I682	6614008102	LINEAR	UPC358C
I638 I682	6614008103	LINEAR	LM358P

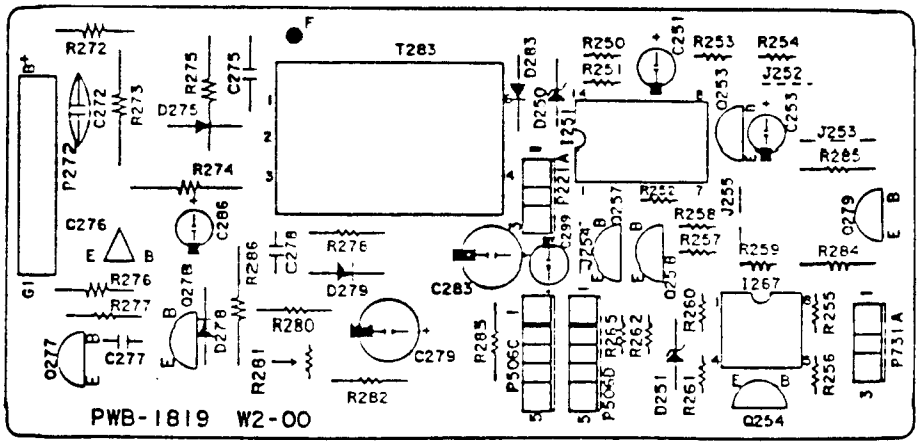
SYMBOL	PARTS NO.	DESCRIPTION	
I683	6610007705	VOLTAGE REGULATOR	A431LP
I683	6610007706	VOLTAGE REFFRENCE	TL431ACLP
I683	6614054300	LINEAR	TL431C-LP
I691	6614177300	LINEAR	HA17393
I691	6614042400	LINEAR	LM393
I691	6614042405	LINEAR	LM393N
I691	6614042404	LINEAR	TA75393P
I701	6614034501	LINEAR	LM833N
I801	6614063103	LINEAR	CS3842A
I801	6614063101	LINEAR	SG3842M
I801	6614063102	LINEAR	UC3842AN
I802	6614011000	LINEAR	AVS1BCF08
I803	6612004300	PHOTO COUPLER	CNX82A.300
I803	6612004301	PHOTO COUPLER	CNX82AX
I803	6612001302	PHOTO COUPLER	TCDT1101G-C
IC501	6617051200	LSI CPU	TMP47P400AN
IC502	6614069800	LINEAR	PST518A
IC504	6617044001	LSI	M6M80021P
IC505	6612000900	D/A CONVERTER	UP6336C
IC506 I507	6616017102	DIGITAL	7407
IC506 IC507	6616017103	DIGITAL	HD7407P
IC506 IC507	6616017100	DIGITAL	SN7407N
IC508	6616038200	DIGITAL TTL	HD74LS47P
IC508	6616001800	DIGITAL	SN74LS47N
IC510	6610001900	VOLTAGE REGULATOR	AN7805

5.1 DIFFERENT MODEL PARTS L. .

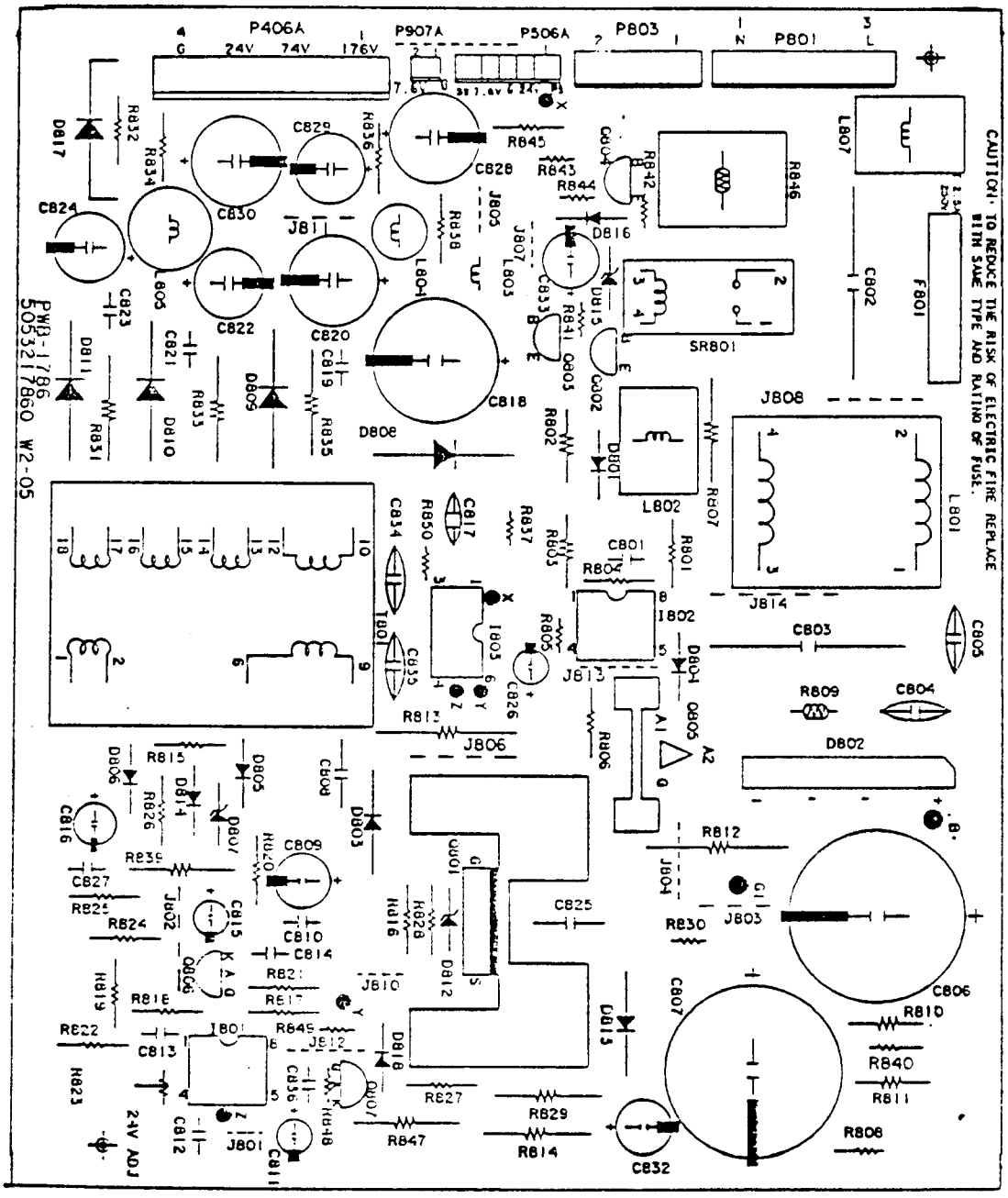
	CM20MKR			CM17MKR		
C312	5210403501	1000u	35V	•	•	•
C492	5223447401	0.47u	250V	5223527401	0.27u	400V
C494	5223412401	0.12u	250V	5223468301	0.068u	250V
C495	5223415401	0.15u	250V	5223410401	0.1u	250V
C496	5270433402	0.33u	400V	5270422402	0.22u	400V
C497	5270601402	1u	250V	5270468401	0.68u	400V
C498	5270601402	1u	250V	5270468401	0.68u	400V
C707	5232312191	120P	500V	5247356091	56P	500V
C707	•	•	•	5232310191	100P	500V
D221B	5057403083	220mm	3P	5057403076	420mm	3P
D731	6618014301	LED	•	6618019900	LED	•
J905	5057403017	3P		•	•	
LA86	5062226600	TLH-266	•	5062226602	TLH-266B	•
LA86	•	•	•	5062226601	TLH-266A	•
L811D	505720295		•	•	•	•
L901	5060118500	TSB-185		5060118702	TSB-187B	
P731	5057403079	650mm	3P	5057403080	370mm	3P
R306	5142110495	1/6W	100K	5142147395	1/6W	47K
R311	5162162820	PN06FB104AR	100K	5062162880	PN06T4B101AR	
R314	5162163420	PN06FB474AR	470K	5162163480	PN06T4B471AR	
R346	5142113495	1/6W	130K	5142113495	1/6W	130K
R346	•	•	•	5142118495	1/6W	180K
R362	5142122495	1/6W	220K	5142112495	1/6W	120K
R364	5142147495	1/6W	470K	5142130495	1/6W	300K
R377	5142182295	1/6W	8.2K	5142110195	1/6W	101K
R377	•	•	•	5142122395	1/6W	22K
R468	5154401024	5W	1	5154412924	5W	1.2
R469	5154401024	5W	1	5154412924	5W	1.2
R667	5142812495	1/4W	120K	5131714538	1/4W	145K
R725	5142110395	1/6W	10K	5142116395	1/6W	16K
R725	•	•	•	5142139295	1/6W	3.9K
R920	5130522903	3W	2.2	5130547903	3W	4.7
R920	•	•	•	5130522903	3W	2.2
S801A	5057433006	500mm	3P	5057403006	430mm	3P
S801E	5057420296	170mm	2P	6140071911		
U501	5053217980	PWB-1798	•	5053217970	PWB-1797	•
V901	5051229810	M48KMZ180X11		5051229710	M41KVZ180X12	
V901	•	•		5051233000	AF17G9SLB22-E-TC28	
V901A	5056306709	HPS0380-01-110	•	5056306719	HPS0380-01-100	•
V901A	•	•	•	5056306709	HPS0380-01-110	•
Y101	5035111025		•	5035110231		

6.0 PCB LAYOUT

17"/20" POWER SAVING BOARD

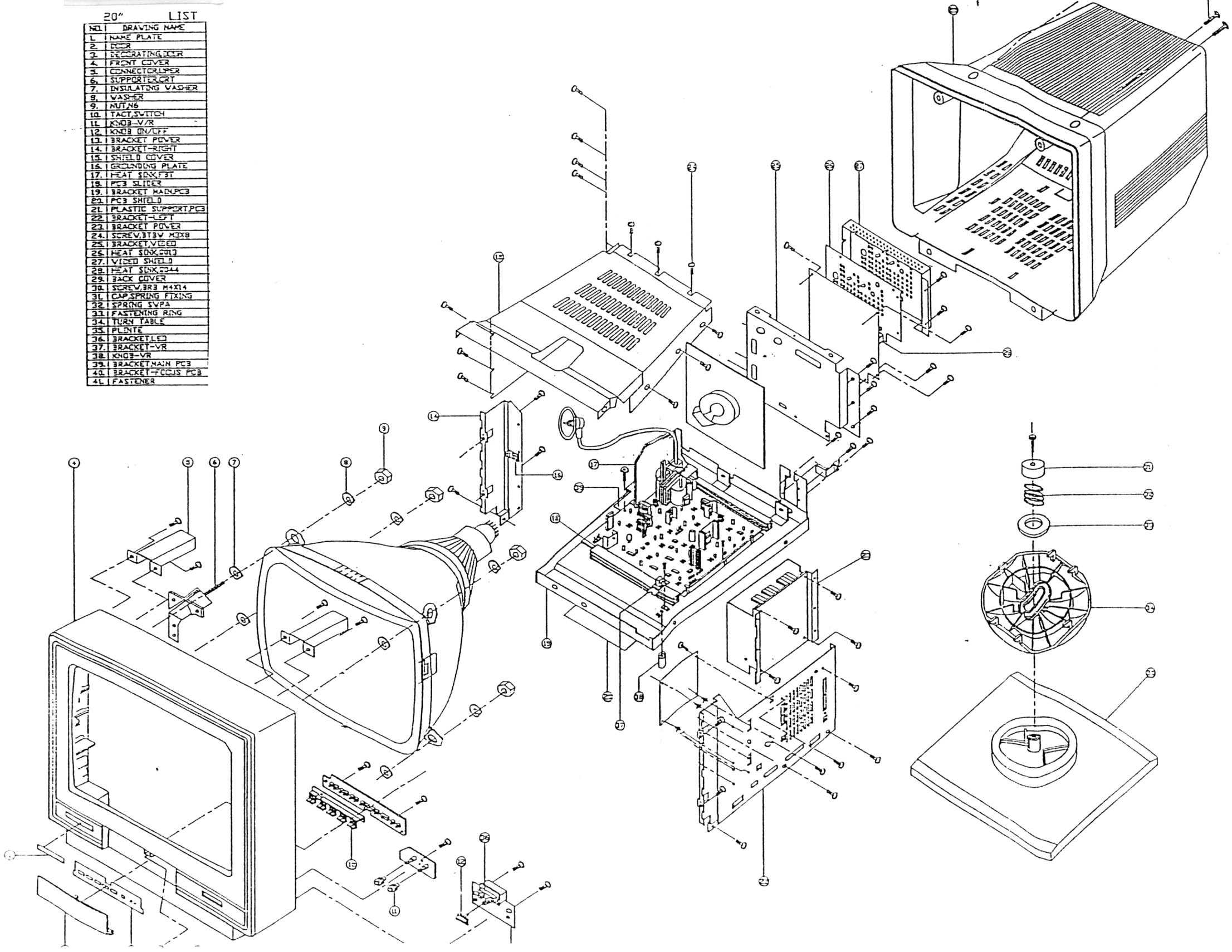


17"/20" SMP POWER BOARD



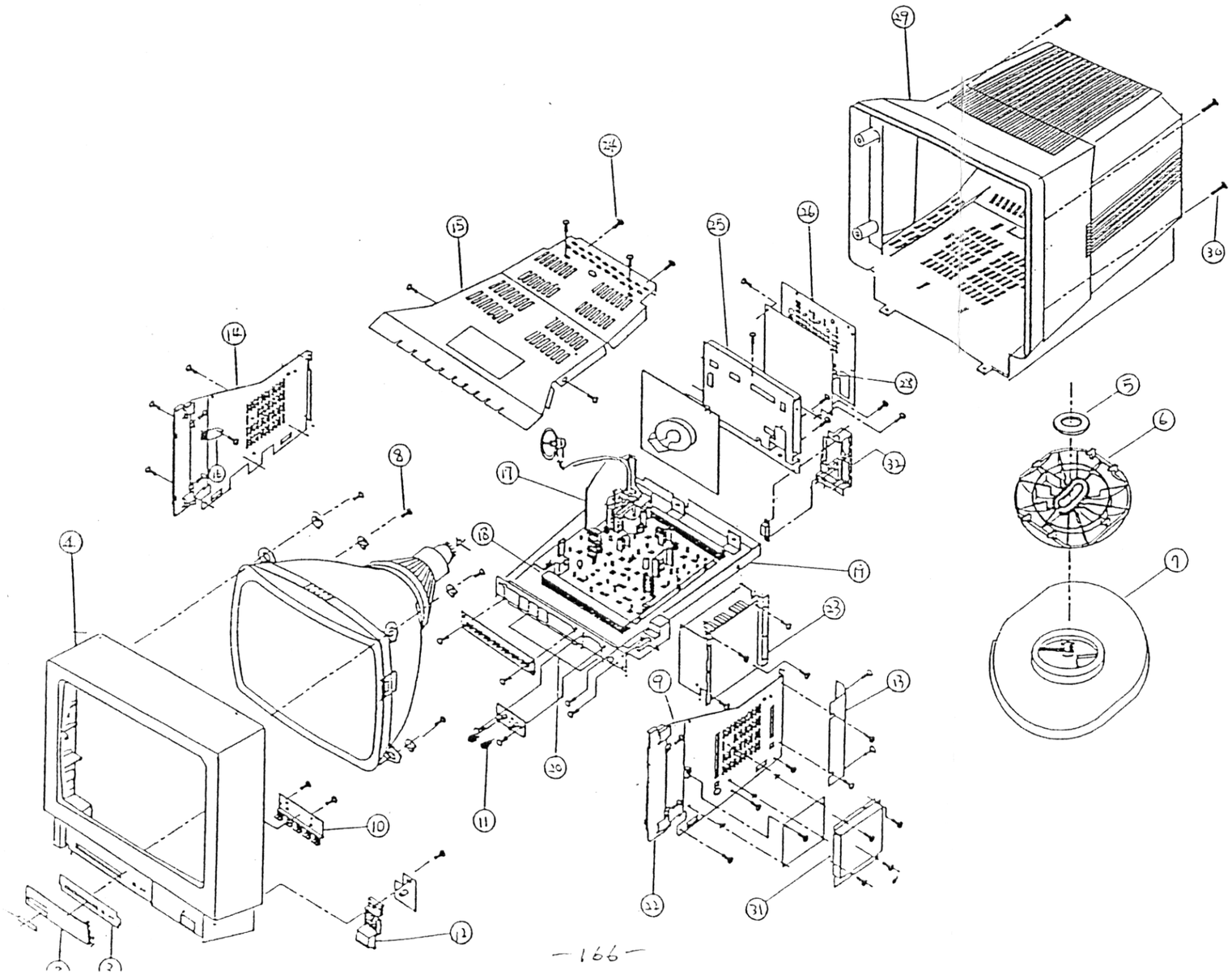
20" LIST

NO.	DRAWING NAME
1.	NAME PLATE
2.	DOOR
3.	DECORATING DOOR
4.	FRONT COVER
5.	CONNECTOR UPER
6.	SUPPORTER CRT
7.	INSULATING WASHER
8.	WASHER
9.	NUT M6
10.	TACT SWITCH
11.	KNOB-V/R
12.	KNOB ON/OFF
13.	BRACKET POWER
14.	BRACKET-RIGHT
15.	SHIELD COVER
16.	GROUNDING PLATE
17.	HEAT SINK F3T
18.	PCB SLIDER
19.	BRACKET MAIN PCB
20.	PCB SHIELD
21.	PLASTIC SUPPORT PCB
22.	BRACKET-LEFT
23.	BRACKET POWER
24.	SCREW,BT3V M3X8
25.	BRACKET,VIDEO
26.	HEAT SINK,2013
27.	VIDEO SHIELD
28.	HEAT SINK,2344
29.	BACK COVER
30.	SCREW,BR3 M4X14
31.	CAP,SPRING FIXING
32.	SPRING SVPA
33.	FASTENING RING
34.	TURN TABLE
35.	PLINTE
36.	BRACKET,LED
37.	BRACKET-VR
38.	KNOB-VR
39.	BRACKET,MAIN PCB
40.	BRACKET-FCC,US PCB
41.	FASTENER



6.0 ASSEMBLY METHODES

17"

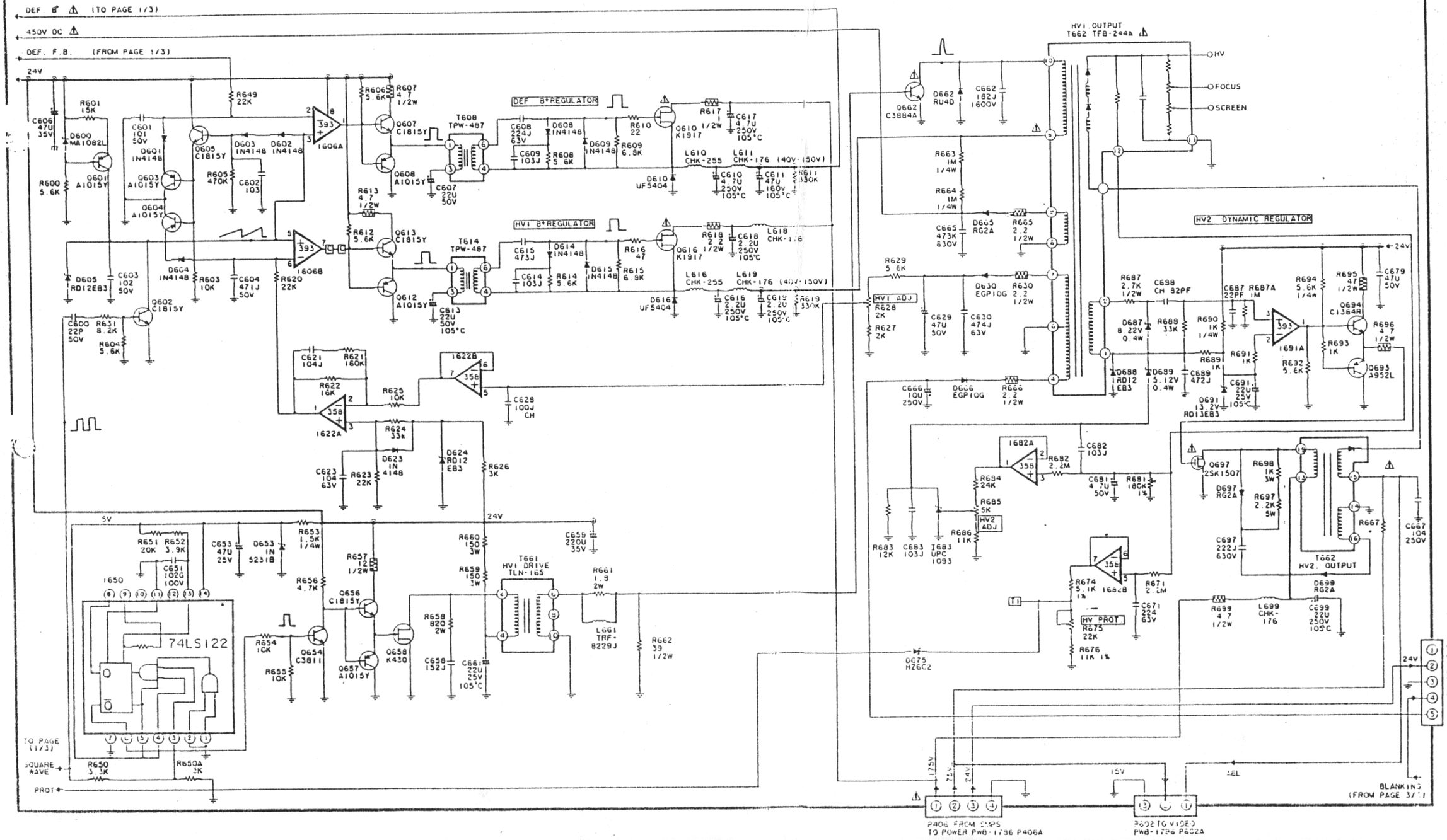


ITEM	DRAWING NAME
1	NAME PLATE
2	DOOR
3	DECORATING,DOOR
4	FRONT COVER
5	FASTENING RING
6	TURN TABLE
7	PLINTH
8	SCREW,PZP M5x20
9	SCREW,PZP M4X12
10	TACT,SWITCH
11	KNOB V/R
12	KNOB,ON/OFF
13	SHIELD,VIDEO(R)
14	BRACKET-LEFT
15	SHIELD COVER
16	GROUNDING PLATE
17	HEAT SINK,FBT
18	PCB SLIDER
19	BRACKET,MAIN PCB
20	PCB SHIELD
21	PLASTIC SUPPORT,PCB
22	BRACKET-RIGHT
23	BRACKET,POWER
24	SCREW,BTBW M3x8
25	BRACKET,VIDEO
26	HEAT SINK,Q913
27	SHIELD,VIDEO(L)
28	HEAT SINK,Q944
29	BACK COVER
30	SCREW,BRB M4x14
31	SHIELD,UP PCB

文件7 MDU

PAGE 2/7

MAIN BOARD(II/III)(PWB-1785) CM17MKR
HV OUTPUT & B+REGULATOR CIRCUIT CM20MKR



POWER SAVING PWB-1819

SWITCHING POWER SUPPLY

T283 TPW-573

R272 2.2
C272 0.01U 500V
R273 150K 2W
R274 150K 2W
R275 100K 1W
C275 103 500V
D275 BYV26D
R286 47K 1W
C286 2.2U 100V
Q276 SC5027-R
D283 RGP10D
C283 100U 25V
R283 680
R250 430 1/4W
12V

Q278 SA1015
C278 242 100V
Q277 SC1815
R277 220
C277 0.1U 50V
R276 4.7 1W
R278 430
D278 6.2V
R280 1K
R281 500
R282 910
D279 RGP10D
C279 100U 25V

D250 5.1V
R252 2K

AUTO RECOVERY CONTROL

R251 30K
C251 3.3U 50V
1251 74LS122
R253 100K
Q253 A1015Y
C253 10U 50V
R254 100
1267 LM393
R255 10K

(AUTO OFF CONTROL SIGNAL INPUT)

Q257 C1815Y
C299 100U 10V
C265 0.1U 50V
R256 100
Q254 C1815Y
R260 1K
R261 10K
D251 3.2V
R257 1K
R259 4.7K
R258 100
Q258 C1815Y
R284 1K
Q259 C1815
R285 1K
R262 1K
P731A TO LED BOARD
PWB-1796-3
PWB-1796-4

V.SYNC
POWER SAVING SWITCH
(AUTO OFF CONTROL SIGNAL OUTPUT)
O/P

P506C TO MICRO BOARD (PWB-1796-2)P506
P506D TO POWER BOARD (PWB-1786)P506A
P221A TO VIDEO BOARD (PWB-1796) P221

82.12.24

DYNAMIC FOCUS CM17MKR (PWB-1795)
/CRT DRIVE BOARD CM20MKR

P701 (TO MAIN BOARD PWB-1785 P701A)

DYNAMIC FOCUS

CRT / CKT NO	R707	R708	R712	C707	R725
HITACHI 20" M48KMZ180X11(N)	2.2K 1/4W	10K 1/4W	3.6K 1/6W	121J 500V	10K 1/6W
HITACHI 17" M41KVZ180X12	12K 1/4W	5.1K 1/4W	3.6K 1/6W	100P 500V	3.9K 1/6W
MITSUBISHI 17" AF17G9SLB22-E	12K 1/4W	5.1K 1/4W	3.6K 1/6W	56P 500V	16K 1/6W

DF3 DF2 DF1

C704 103 400V
C723 104
C710 56P 50V
R711 10K
R708 R707
Q704 C1941
R714 2.2K 1/2W
Q705 C4686A
C709 152 1.6KV
D701 1N4148
C707
R715 150K 1/2W
R716 1.5K 1/2W
Q706 C4686A
C711 102 50V
R712
R713 330 1/4W
R717 1.2K 1/6W
C708 222

24V

R726 36K
R751 160K 1/2W
R752 120K 1/2W
Q707 C1815Y
C725 10U 50V
R733 270K 1/2W
Q708 C4686A
TP
SG701 1KV
R761 7.5K
R725
R727 18K
R728 3.3K 1/4W
R735 8.2K

P703 (TO MAIN BOARD)

P903 (TO VIDEO PWB-1796 P903A)
P902 (TO VIDEO PWB-1796 P902A)
P901 (TO VIDEO PWB-1796 P901A)

CRT DRIVE BOARD

CRT TYPE	CRT SOCKET	R920	D909
HITACHI 17"	HPS0390-01-110	3W 2.2	JUMPER
HITACHI 20"	HPS0380-01-110	3W 2.2	3A2
MITSUBISHI17	HPS0380-01-100	3W 4.7	JUMPER

R902 33 1/2W
R908 430
L902 TRF-1019
R901 33 1/2W
R907 430
L904 TRF-1019
R903 33 1/2W
R909 430
L903 TRF-1019
KR KG KB H G G2
V901
Z902 1P1 20KV
Z901 1P1 20KV
Z903 1P1 20KV
Z905 1P1 30KV

Blanking
C904 224J 250V
C908 101K 2KV
C911 22U 250V
R914 100
R915 1M
D902 RGP10G
Q901 2SC1921
R913 22 1/4W
C909 102K 1KV
R917 3.6K 1/2W
-210V
D903 1N5252B
D904 HZ33
D905 HZ33
D906 HZ33
D907 D908 HZ33
R911 110K
VR907 100K
D909 3A2
D971 RGP10G
R912 1M
R919 47K
R920 2.2 3W
C901 103K 1KV
R905 1M 1/2W
P905
C912 0.1U 50V

P904 (TO MAIN BOARD PWB-1785 P904A)
P907 (TO POWER BOARD PWB-1786 P907A)
P908 (TO CRT GROUNDING)

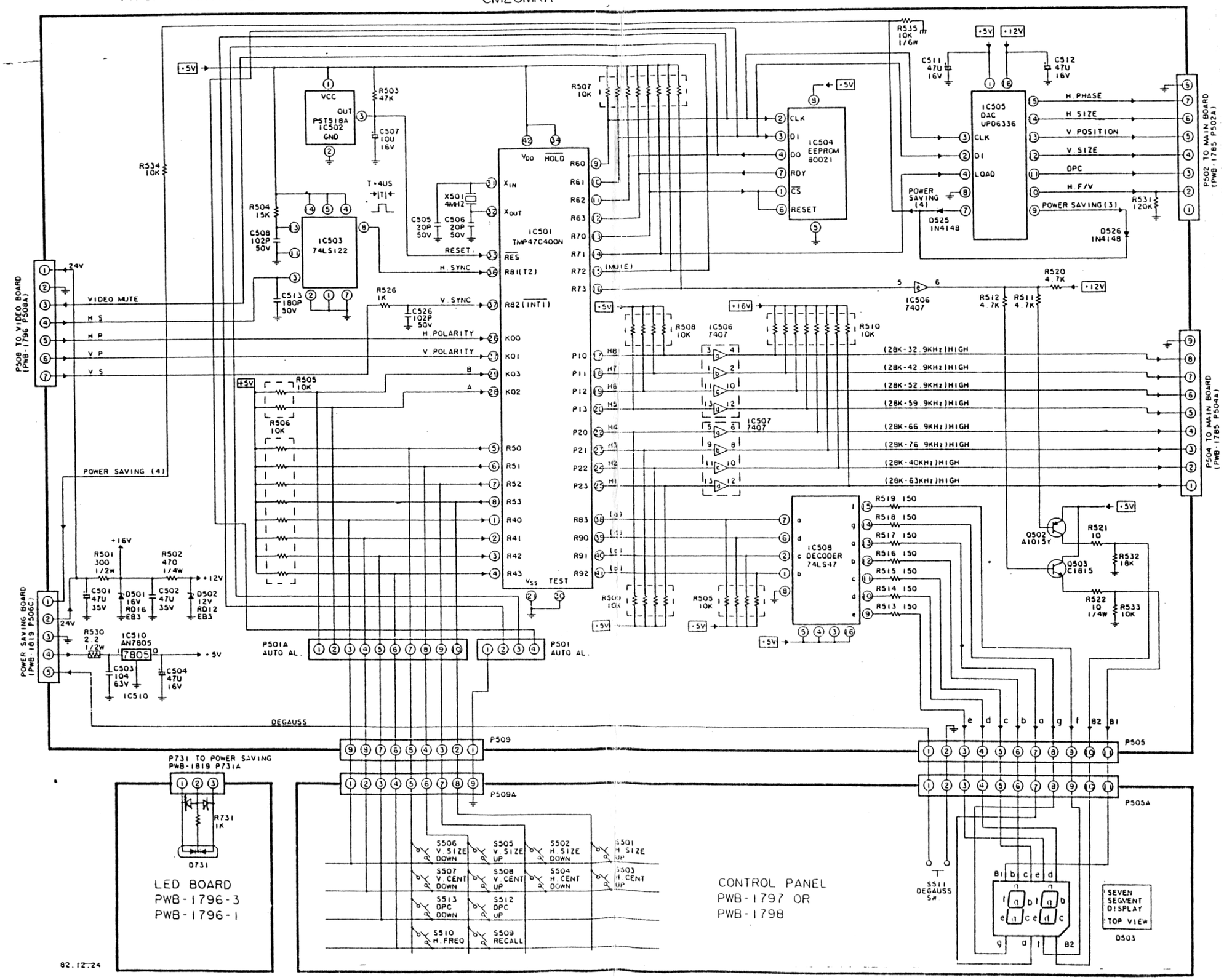
文件7 MDC
編號

PAGE 5/7

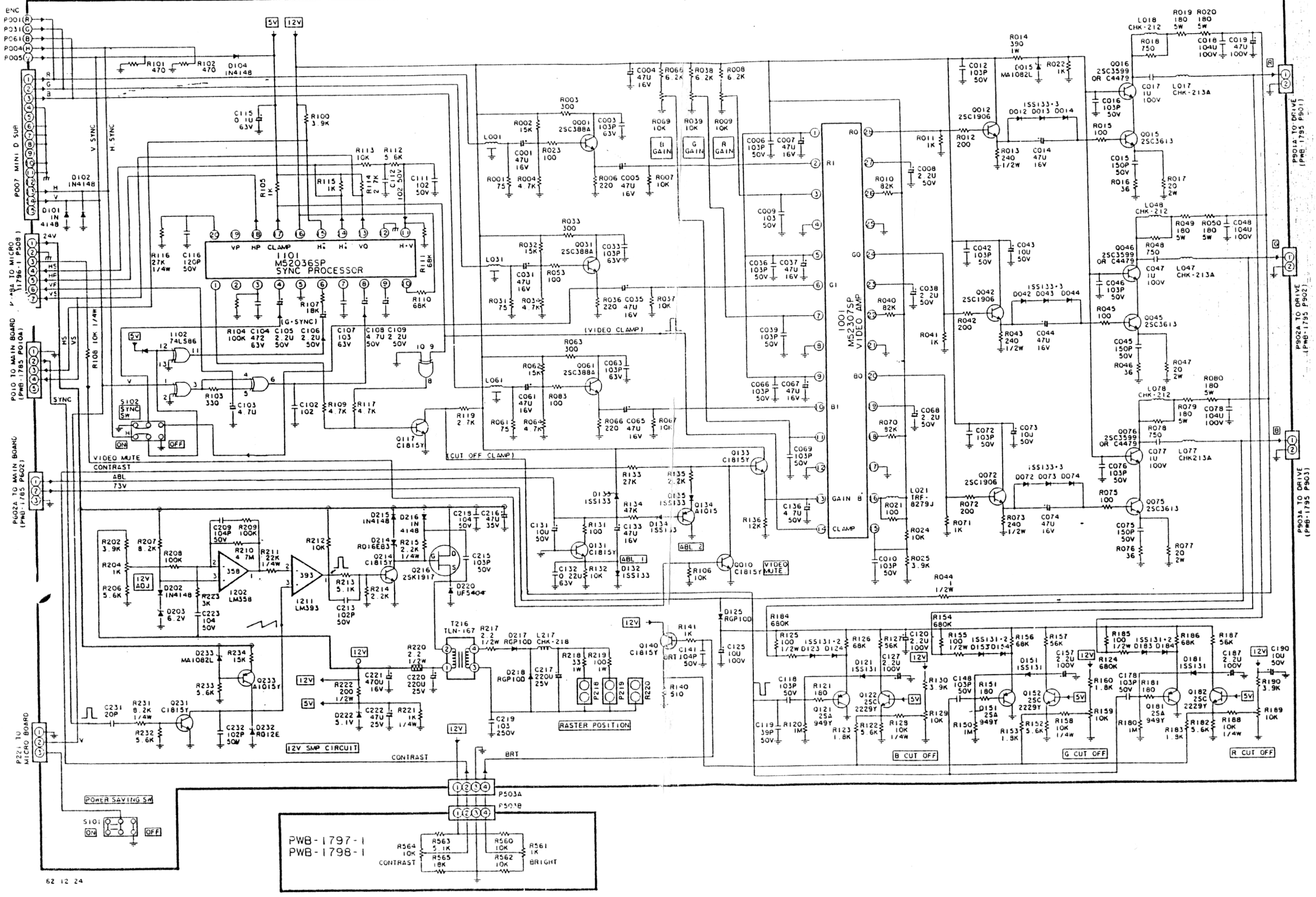
MICRO CONTROL CIRCUIT (PWB-1796-2)

CM17MKR
CM20MKR

MDO



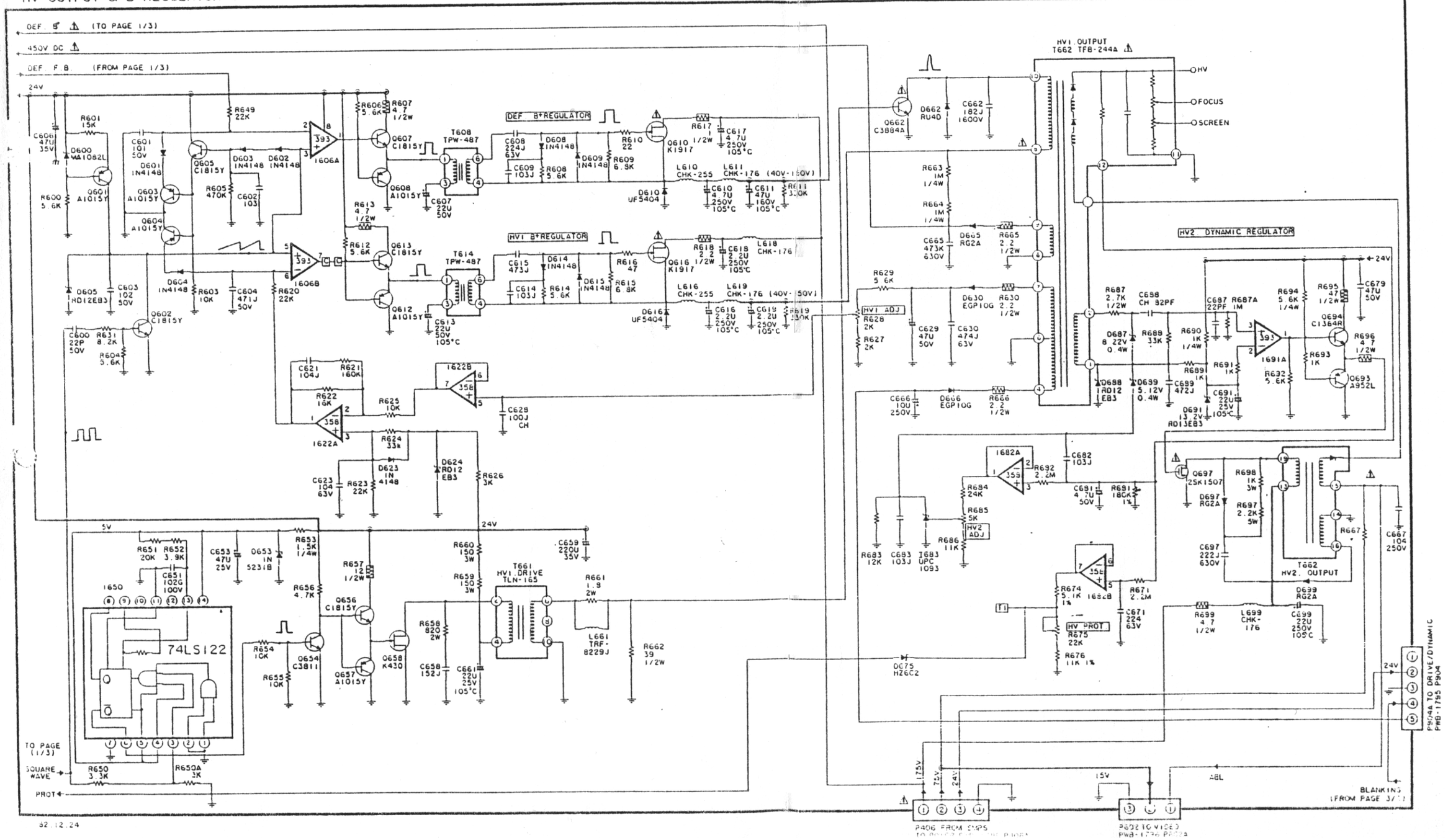
VIDEO BOARD (PWB-1796) CM17MKR CM20MKR PAGE 4/7



62 12 24

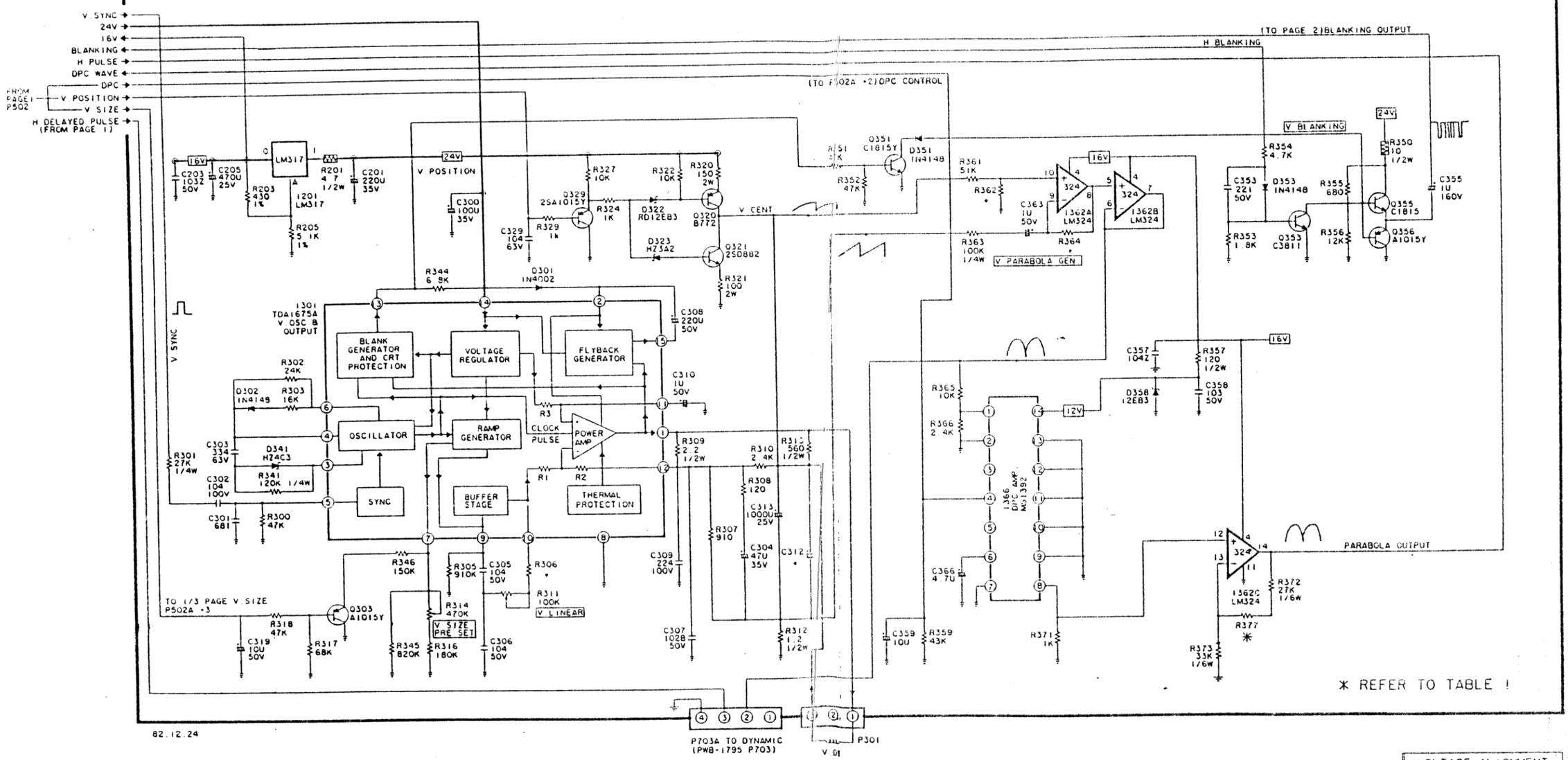
PAGE 2/7

MAIN BOARD(II/III)(PWB-1785) CM17MKR
HV OUTPUT & B+REGULATOR CIRCUIT CM20MKR



文件7 MDC
編號

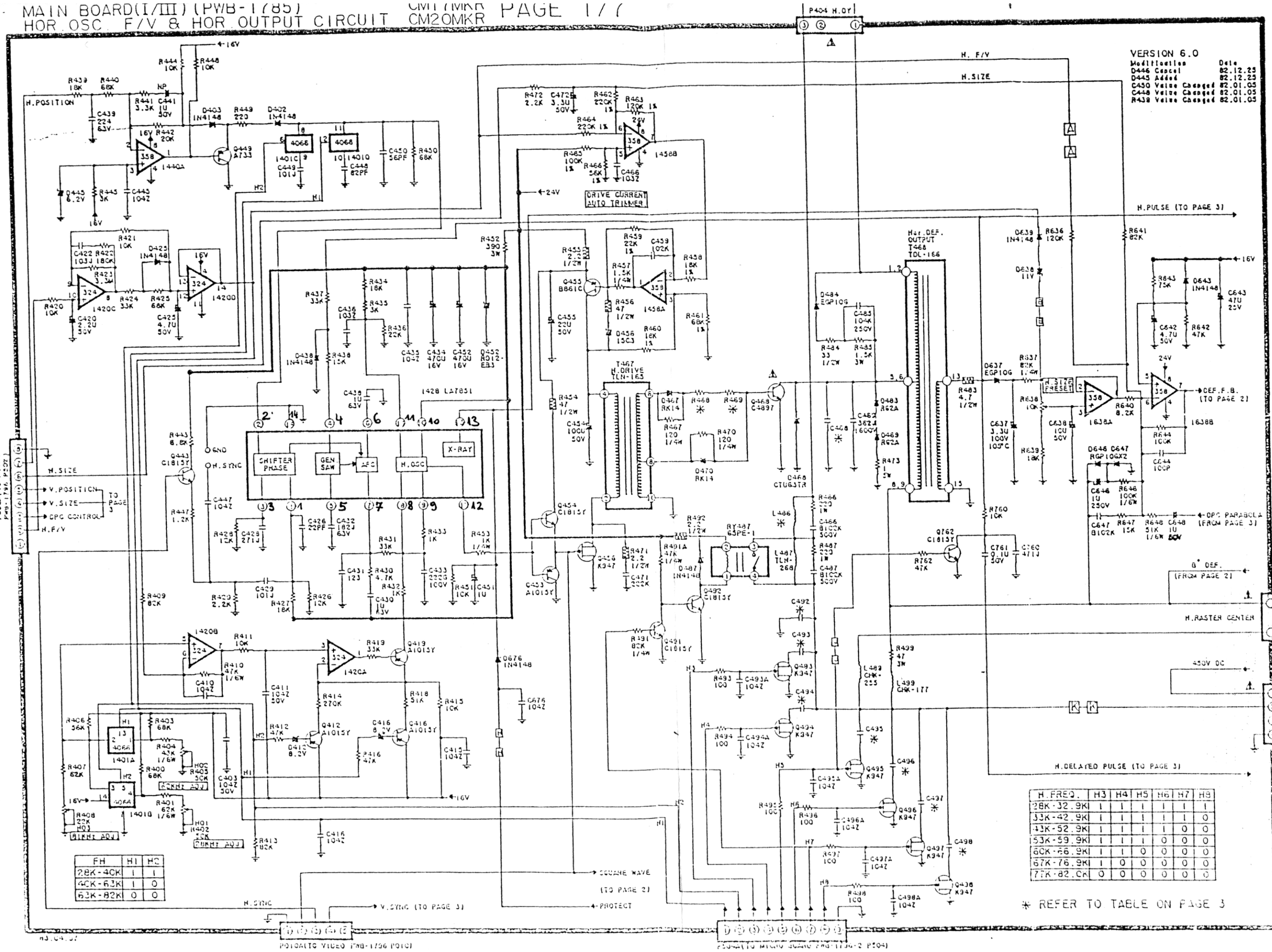
MAIN BOARD(PWB-1785)(111/111)CM17MKR
VERTICAL & PARABOLA CIRCUIT CM20MKR PAGE 3/7



82.12.24

MAKER	CRT TYPE	L486	C468	C492	C493	C494	C495	C496	C497	C498	R468	R469	C312	R306	R346	R362	R364	R377	R667	VOLTAGE ALIGNMENT			
																				B DEF max	HV1	HV2	G1
HITACHI	20"M48KMZ180X11(N)	TLH-266	432U 1600V	0.47uF 250V	0.12uF 250V	0.12uF 250V	0.15uF 250V	0.33uF 400V	1uF 250V	1uF 250V	1 5W	1 5W	1000UF 25V	100K 1/6W	130K 1/6W	220K 1/6W	470K 1/6W	8.2K 1/6W	120K 1/4W	110V (81K)	24KV	26KV5	-70V
HITACHI	17"M41KVZ190X12	TLH-266A	362U 1600V	0.27uF 400V	680 250V	0.12uF 250V	0.1uF 250V	0.22uF 400V	0.68uF 400V	0.68uF 400V	1.2 5W	1.2 5W	NULL	47K 1/6W	180K 1/6W	120K 1/6W	300K 1/6W	22K 1/6W	145K 1/4W	107V (81K)	22KV5	25KV	-60V
MITSUBISHI	17"AF17G9SLB22-E	TLH-266B	332U 1600V	0.27uF 400V	680 250V	0.12uF 250V	0.1uF 250V	0.22uF 400V	0.68uF 400V	0.68uF 400V	1.2 5W	1.2 5W	NULL	47K 1/6W	130K 1/6W	120K 1/6W	300K 1/6W	100 1/6W	145K 1/4W	118V (91K)	24KV	26KV5	-80V

MAIN BOARD(I/III)(PWB-1785) CM17MKR PAGE 17
HOR OSC F/V & HOR OUTPUT CIRCUIT CM20MKR



FH	H1	H2
28K-40K	1	1
40K-63K	1	0
63K-82K	0	0

H.FREQ.	H3	H4	H5	H6	H7	H8
28K-32.9K	1	1	1	1	1	1
33K-42.9K	1	1	1	1	1	0
43K-52.9K	1	1	1	1	0	0
53K-59.9K	1	1	1	0	0	0
60K-66.9K	1	1	0	0	0	0
67K-76.9K	1	0	0	0	0	0
77K-82.0K	0	0	0	0	0	0

DYNAMIC FOCUS CM17MKR(PWB-1795)
/CRT DRIVE BOARD

DYNAMIC FOCUS

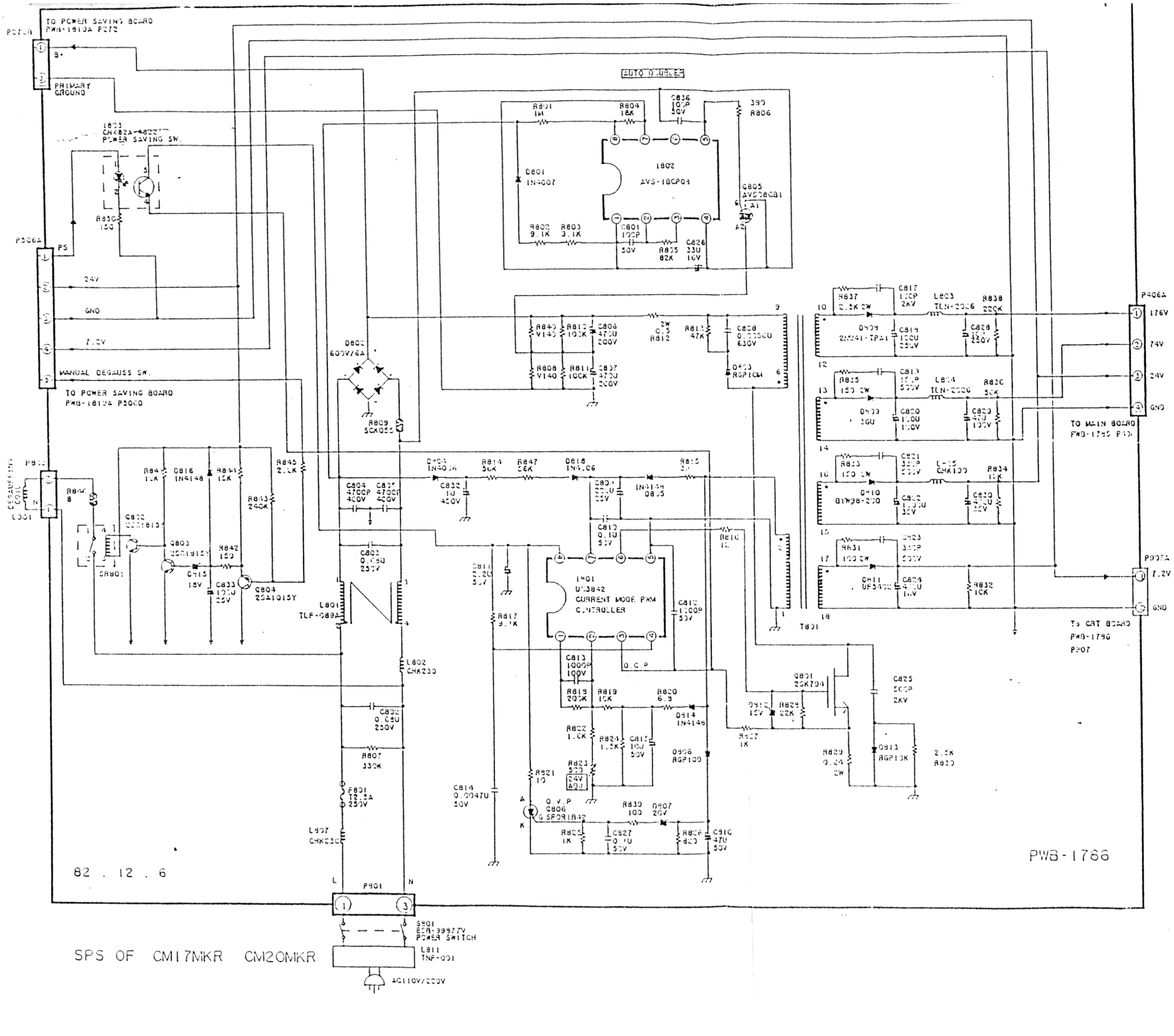
CRT ＼ CAT.NO.	R707	R708	R712	C707	R725
HITACHI 20" M48KMZ18.X11(N)	2.2K 1/4W	10K 1/4W	3.6K 1/6W	121J 500V	10K 1/6W
HITACHI 17" M41KVZ18GX12	12K 1/4W	5.1K 1/4W	3.6K 1/6W	100P 500V	3.9K 1/6W
MITSUBISHI 17" AF17G9SL022-E	12K 1/4W	5.1K 1/4W	3.6K 1/6W	100P 500V	16K 1/6W

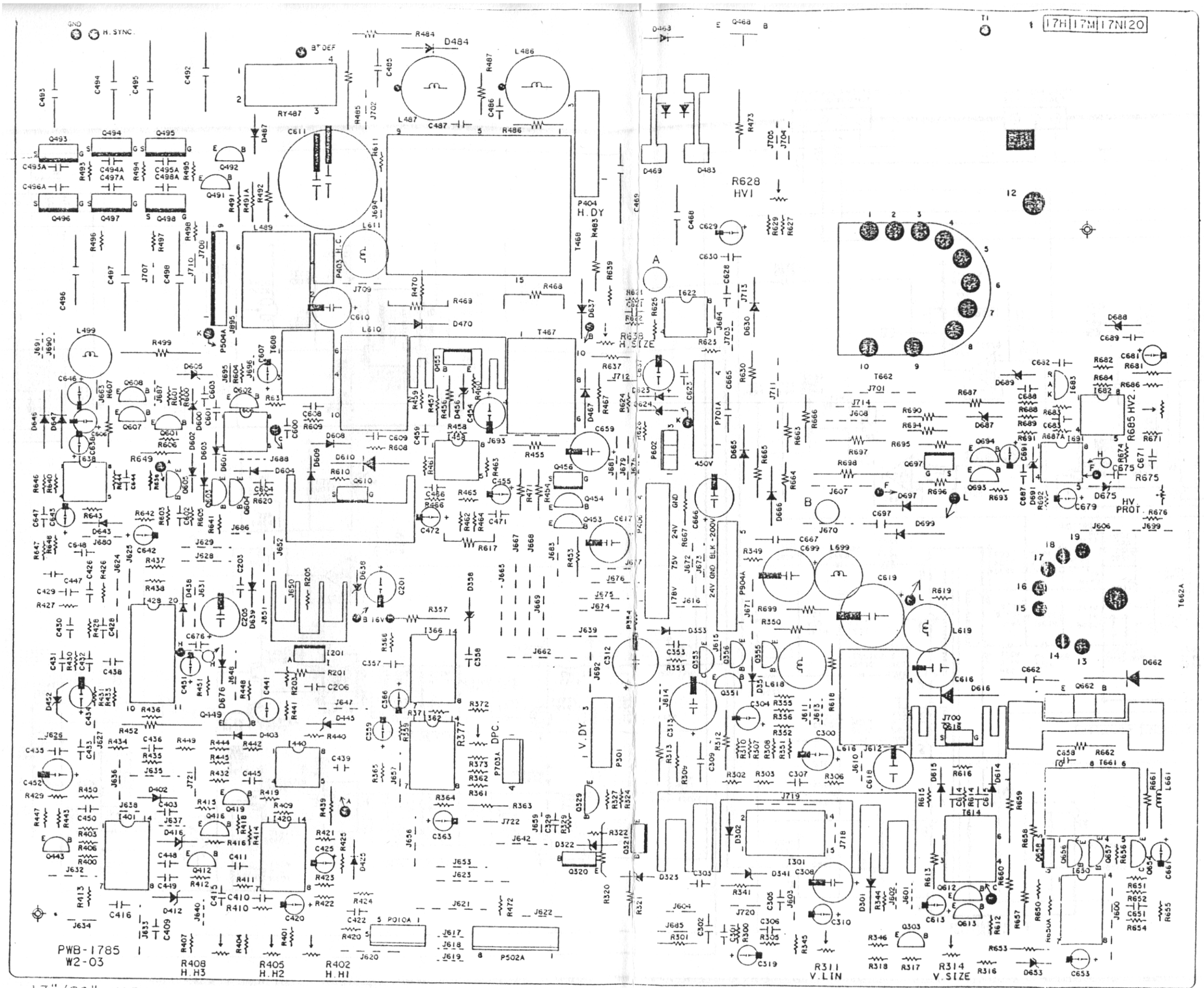
CRT DRIVE BOARD

CRT TYPE	CRT SOCKET	R920
HITACHI 17"	HPS0380-01-110	3W 2.2
HITACHI 20"	HPS0390-01-110	3W 2.2
MITSUBISHI17	HPS0380-01-10J	3W 4.7

P701 (TO MAIN BOARD PWB-1785 P701A)
P703 (TO VIDEO PWB-1796 P903A)
P902 (TO VIDEO PWB-1796 P902A)
P901 (TO VIDEO PWB-1796 P901A)
CF3 CF2 CF1
24V
C723 104
C704 103 400V
C710 56P 50V
R711 10K
R708 R707
C711 102 50V
R712
R713 330 1/4W
Q704 C1941
Q706 C4686A Hor.AMP.
R714 2.2M 1/2W
Q705 C4686A
C709 152 1.6KV
Q701 1N4148
C707
R715 150K 1/2W
R716 1.2K 1/2W
R717 1.2K 1/6W
C708 222
R761 7.5K
R726 36K
R725
R727 18K
Q707 C1815Y
C725 10U 50V
R728 3.3K 1/4W
Q708 C4686A VERT.AMP.
R751 160K 1/2W
R752 120K 1/2W
R733 270K 1/2W
R735 8.2K
TP
SG701 1KV
R902 33 1/2W
R908 430
R901 33 1/2W
R907 430
L904 TRF-1019
L902 TRF-1019
R903 33 1/2W
R909 430
L903 TRF-1019
Z902 1PI 200V
Z901 1PI 200V
Z903 1PI 200V
KR
KG
KB
V901
Blanking
C904 224J 250V
C908 101K 2KV
C911 22UI 250V
R915 1M
Q902 RGP10G
Q901 2SC1921
N1
R914 100
R913 22 1/4W
C913 102K 1KV
Z905 1PI 300V
R920 2.2 3W
C901 103K 1KV
R905 1M 1/2W
P905
C912 0.1U 50V
R917 3.6K 1/2W
-210V
D903 1N52528
D904 HZ33
D905 HZ33
D906 HZ33
D907 HZ33 D908 HZ33
VR907 100K
SUB BRT.
R911 110K
D909 SA2
D901 RGP10G
R912 1M
R918 47K
SPOT KILLER
83.04.07
P703 (TO MAIN BOARD PWB-1785 P703A)
P904 (TO MAIN BOARD PWB-1785 P904A)
P907 (TO POWER BOARD PWB-1786 P907A)
P908(TO CRT GROUNDING)

Modifications	Date
C813 Value Changed Q806 Device Changed C836 Added	82 12 3
R812 Value Changed D917 Canceled D811 Device Changed D810 Device Changed C801 Value Changed R844 Value Changed	82 12 6

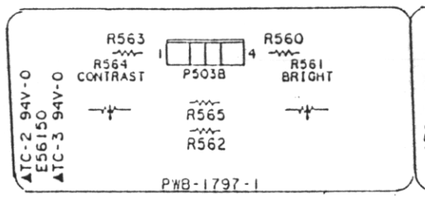




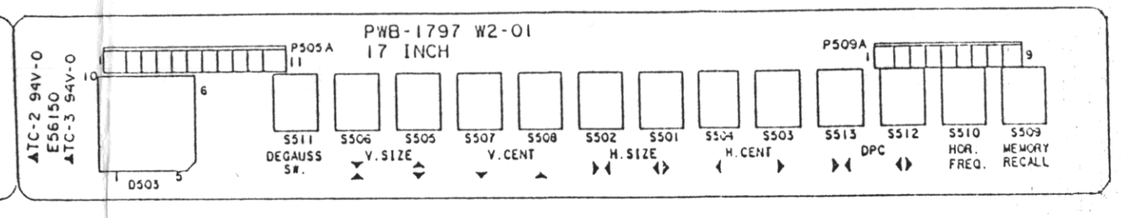
17"/20" MAIN BOARD

6.0 PCB LAYOUT

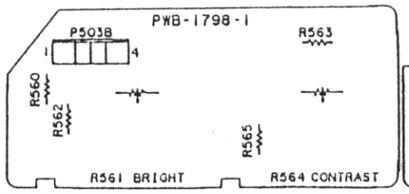
17" VR CONTROL BOARD



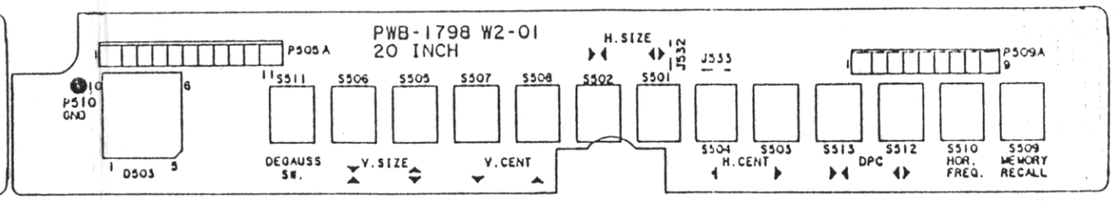
17" DIGITAL CONTROL BOARD



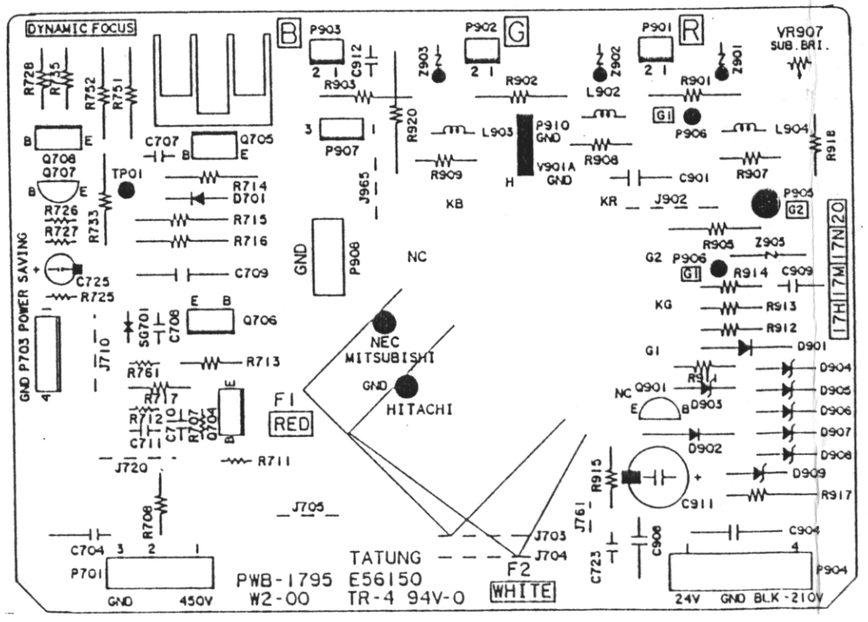
20" VR CONTROL BOARD



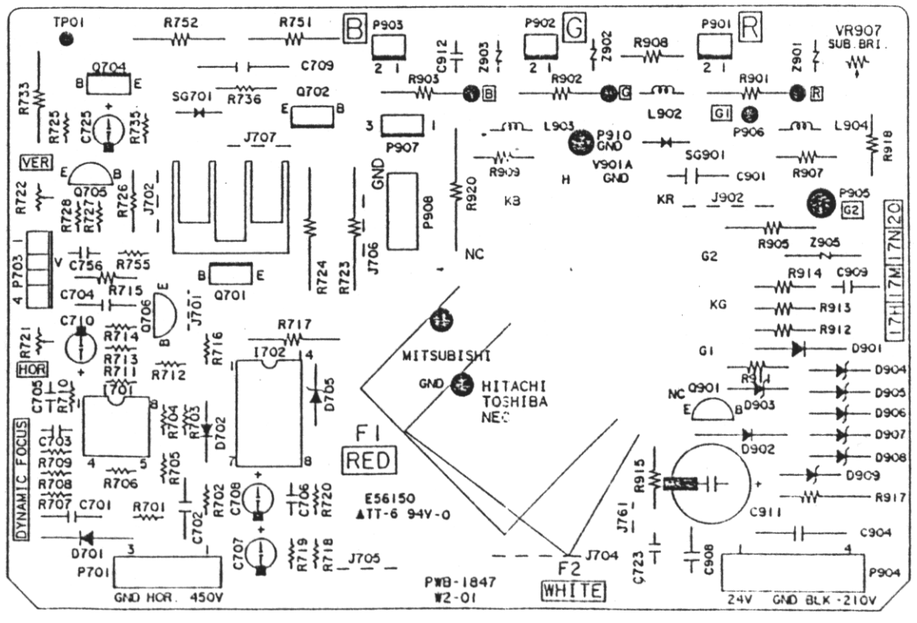
20" DIGITAL CONTROL BOARD



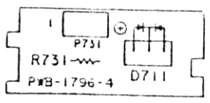
17"/20" CRT DRIVE BOARD



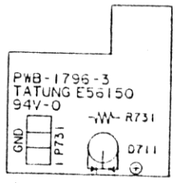
17"/20" CRT DRIVE BOARD

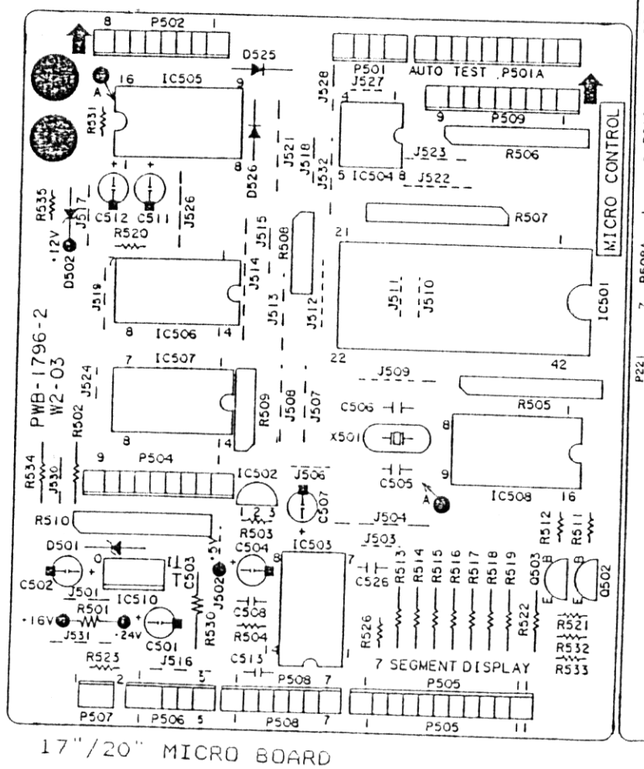


20" LED BOARD

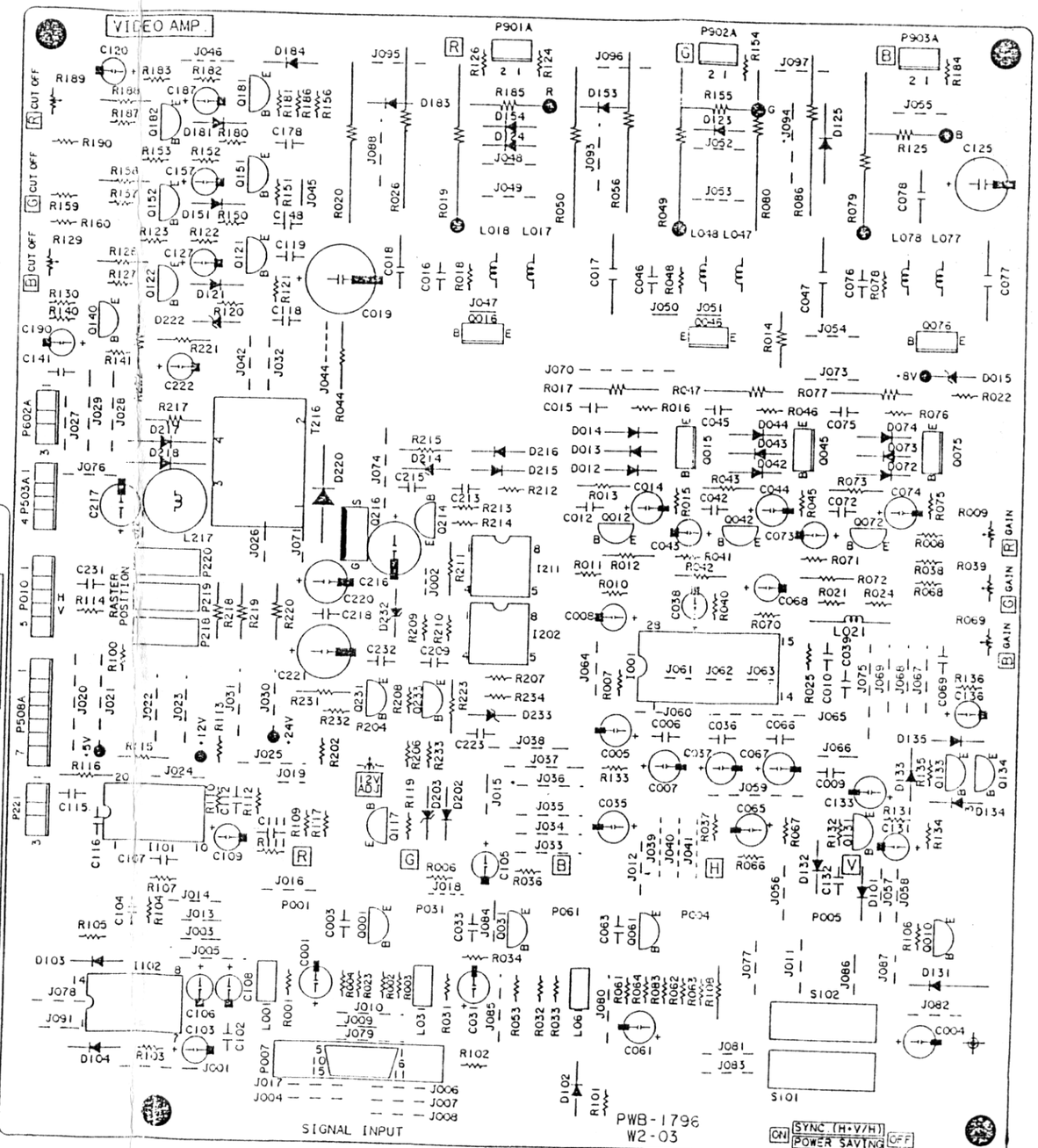


17" LED BOARD





17"/20" MICRO BOARD



17"/20" VIDEO BOARD